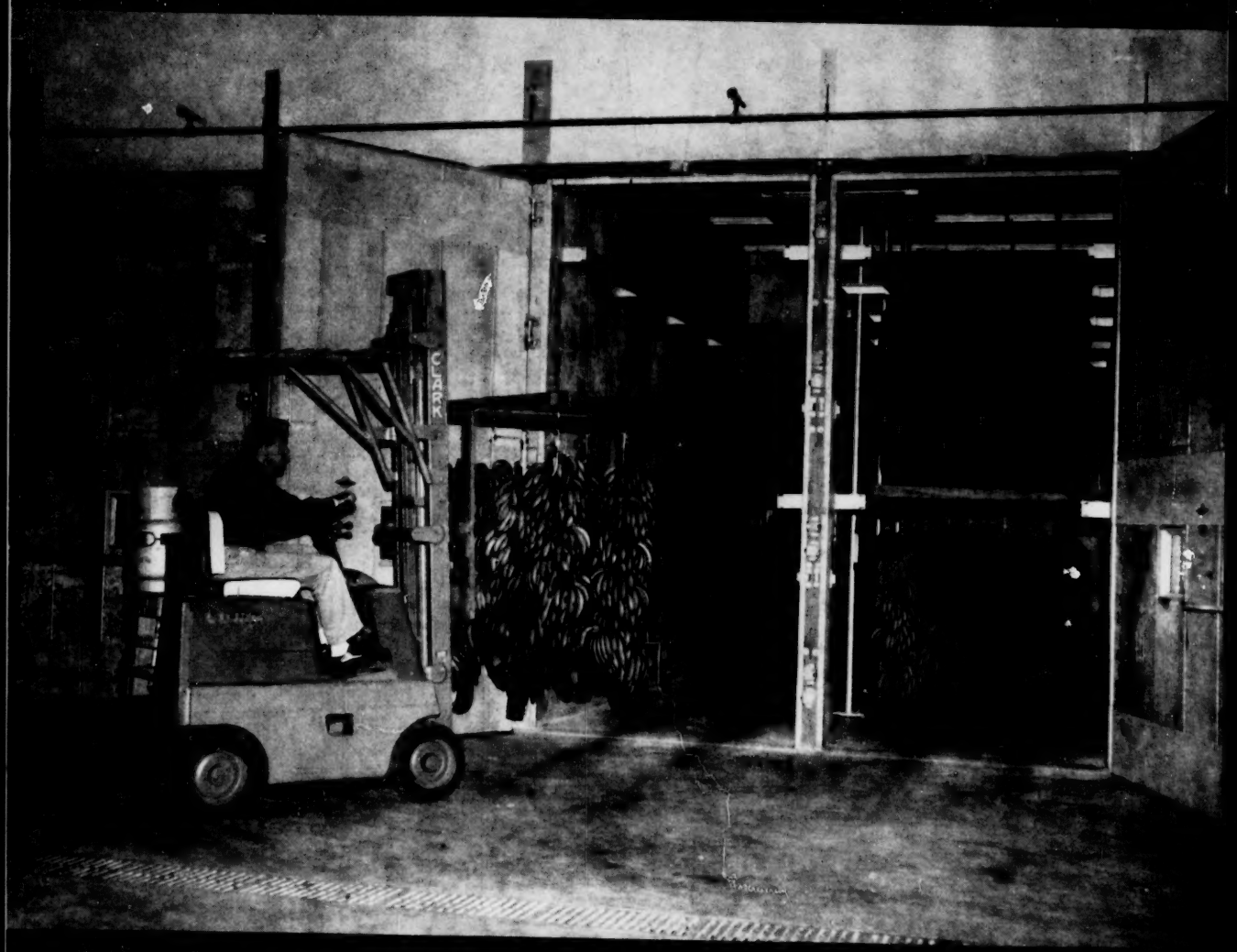
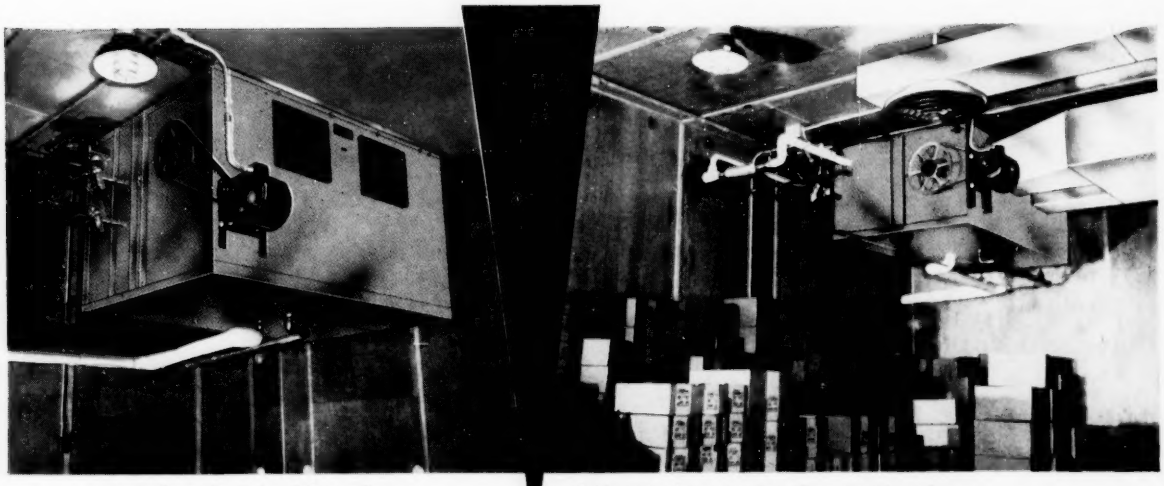
INDUSTRIAL REFRIGERATION



RAPID...

Complete Defrosting With Glycol

in



Levitz Frozen Foods, Inc., Lebanon, Penna.

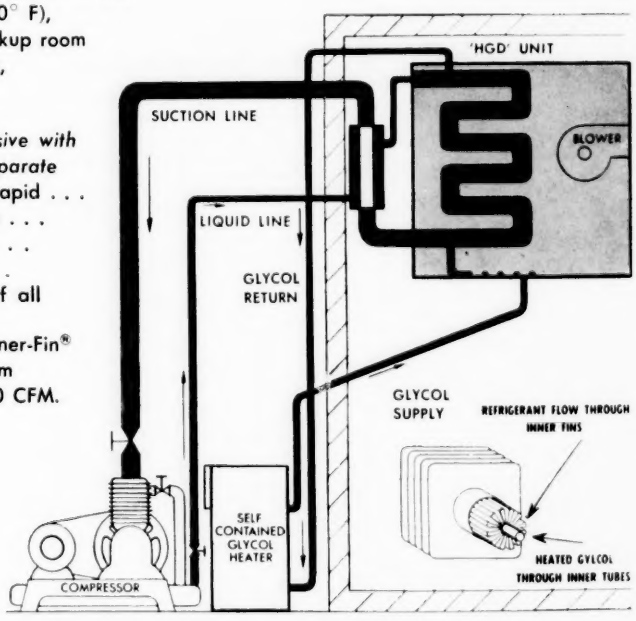
Refrigeration Contractor: Herre Bros., Harrisburg, Penna.
Consulting Engineers: V. C. Patterson & Associates, York, Penna.

Dunham-Bush Heavy Duty Product Coolers

Dunham-Bush 'GD' Glycol Defrost product coolers in the sharp freeze room (maintained at minus 30° F), meat storage room (minus 10° F) and breakup room (0° F) at Levitz Frozen Foods, Inc., Lebanon, Pennsylvania, require defrosting for only 30 *minutes once a day.*

Inner-Fin® construction of these units, *exclusive with Dunham-Bush,* makes possible an *entirely separate* defrost circuit (see diagram). Defrosting is rapid . . . room temperature rise is held to a minimum . . . no dilution of defrost medium is possible . . . system has "separate-circuit" reliability . . . power economies are marked. Defrosting of all units is automatically controlled.

'GD' units, featuring all copper patented Inner-Fin® construction, are available in capacities from 22,000 to 136,000 BTU/hr., 4,800 to 18,300 CFM.



Request free catalog containing complete information on these and other units in the extensive Dunham-Bush line of *quality* low temperature equipment.

DUNHAM-BUSH

Dunham-Bush, Inc.

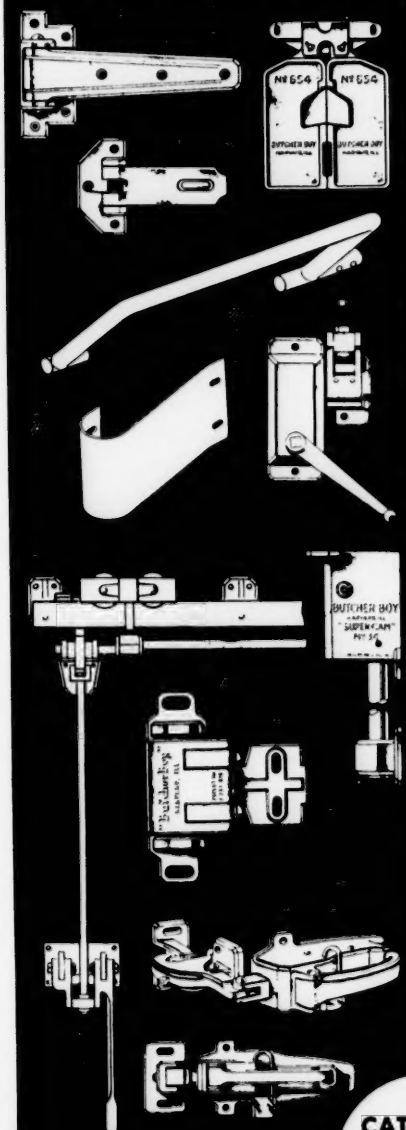
WEST HARTFORD 10 • CONNECTICUT • U. S. A.

AIR CONDITIONING, REFRIGERATION, HEATING PRODUCTS AND ACCESSORIES

"Butcher Boy"
Since 1885

Refrigerator Doors

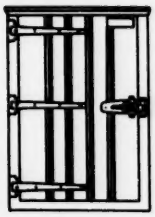
REFRIGERATOR DOOR
HARDWARE



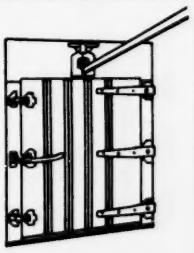
SAFETY RELEASE FASTENERS
No. 11 or No. 12
Permit opening from within even though padlocked from outside

CATALOGS AVAILABLE UPON REQUEST

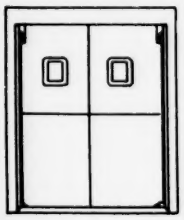
STANDARD COOLER-FREEZER DOORS



- Modern Streamlined Appearance
- 100% Douglas Fir Construction
- Massive and Durable Hardware



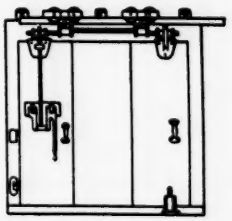
STANDARD VESTIBULE AND AUTO CLOSE DOORS



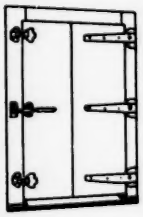
- Double Acting Doors for Loading Docks
- For Heavy Trucking Openings
- Save Refrigeration Losses

HORIZONTAL SLIDING DOORS

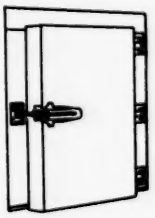
- Ideal where space factor is limited
- Recommended for Freezer Areas
- Available for manual, air, or electric operation
- Mechanically operated doors open and close in less than 4 seconds



LOW TEMPERATURE INFITTING AND SUPER FREEZER OVERLAP DOORS



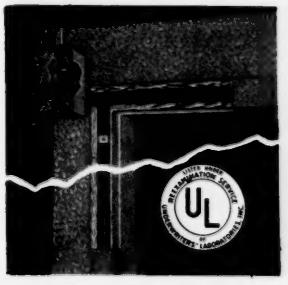
- Low Temperature Doors for +10 to —20° F
- Super Freezer Doors for —0 to —100° F
- Both types available with No. 51 electric defrosters
- Extra heavy duty hardware applications



New!

FULLY AUTOMATIC ELECTRIC DEFROSTERS

- Underwriter's Approved—An exclusive First with Butcher Boy
- Flexible "silicon" covered (not lead covered) heater cables
- Furnished with calibrated "thermostat"—economical heat control



BUTCHER BOY REFRIGERATOR DOOR CO. Dept. "MG" HARVARD, ILLINOIS

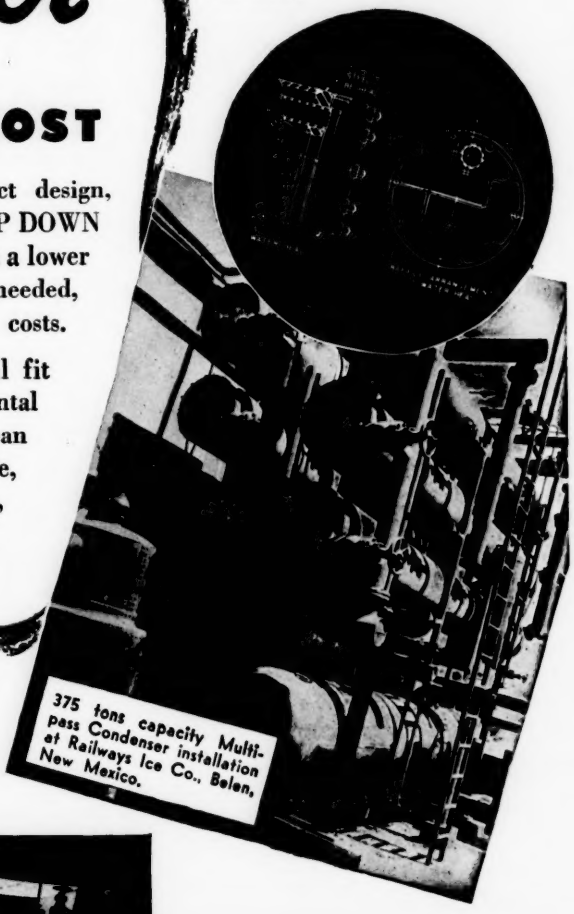
$ave Power and REFRIGERATION COST

Vogt Condensers, because of their correct design, STEP UP the rate of heat transfer and STEP DOWN head pressures. With the liquid delivered at a lower temperature, smaller compressor capacity is needed, saving in original as well as operating costs.

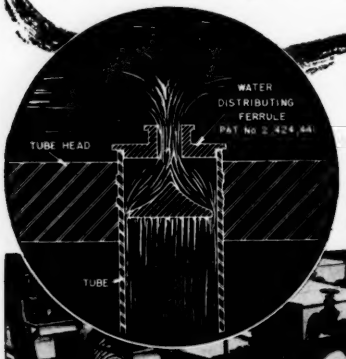
One of the two basic types illustrated will fit your operations exactly. Install Horizontal Multipass (closed type) for use with clean waters. Where the water is hard, forms scale, contains mud or promotes fungus growth, Vertical Single Pass (film type) which can be cleaned in operation, are recommended.

Horizontal Multipass Condensers
(Closed Type)

Water circulated in tubes traverses the length of the unit a number of times as determined by baffles in the heads.

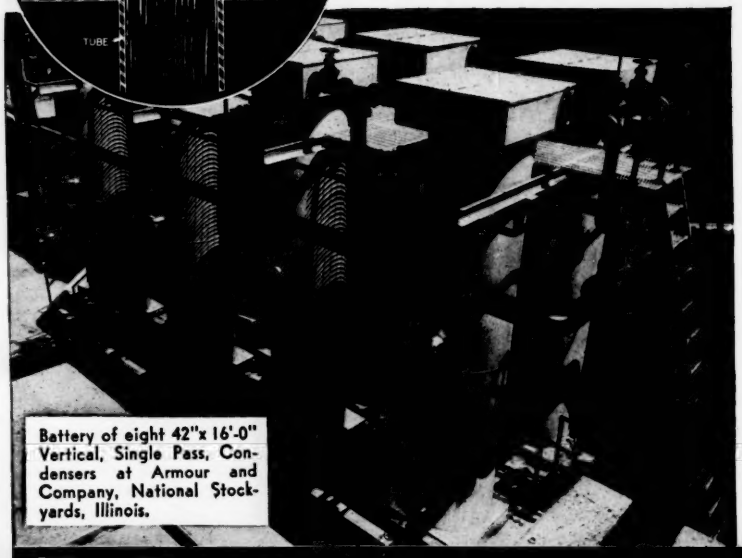


375 tons capacity Multipass Condenser installation at Railways Ice Co., Belen, New Mexico.



Vertical Single Pass Condensers
(Film Type)

Patented ferrules give equal distribution of water to and over the surfaces of all tubes in a unit.



Battery of eight 42"x 16'-0" Vertical, Single Pass, Condensers at Armour and Company, National Stockyards, Illinois.

HORIZONTAL and VERTICAL TYPES SHELL and TUBE CONDENSERS For Every Service

Write For Bulletin RC-2
Address Dept. 24A-RIIR

HENRY VOGT MACHINE COMPANY
INCORPORATED
1000 W. ORMSBY ST., LOUISVILLE 10, KY., U.S.A.
Branch Offices: NEW YORK, CHICAGO, CLEVELAND, DALLAS, PHILADELPHIA, ST. LOUIS, CHARLESTON, W. VA.

Vogt REFRIGERATION CONDENSERS

Industrial Refrigeration

February, 1958

Now in its 67th Year of Publication

Number 2

Vol. 134

J. F. NICKERSON, Founder

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The Cover:

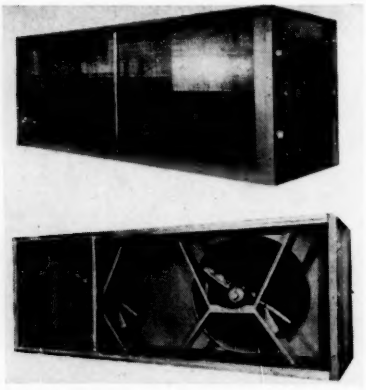
Loading one of eight banana rooms at Red Owl Stores, Inc., warehouse in Hopkins, Minn. This firm recently added produce and frozen foods storages to its 550,000 sq. ft. facilities housing home offices, bakery, coffee roasting, cabinet shop, retail store, cafeteria, and grocery warehouse. Capacity of 150 TR is required for three-level temperatures involved. See article starting on page 13.

What's New

MACHINERY
APPLIANCES • PROCESSES

Air Cooled Heat Exchangers, Condensers by Niagara

NEWLY designed, the "Aero" heat exchanger by the Niagara Blower Co. is now available for installations requiring the cooling of fluids, or condensing vapors, in chemical process, industrial or power applications. The unit consists of an arrangement of heavily finned tubes in a casing through which air is drawn by two propeller type fans.



Back and front views of Aero heat exchanger

Heat transfer is from the fluid through the tube walls and extended surfaces to air that is exhausted into the atmosphere. The new design provides high heat removal capacity per unit by means that insure the movement of air in large volume. There is provision for free drainage of condensate liquids when units are used for condensing.

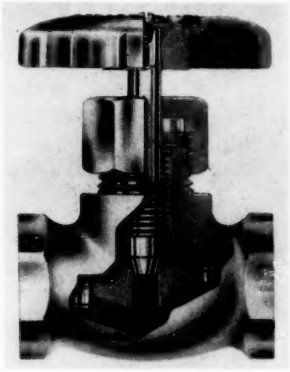
Units are built in a range of four standard sizes up to maximum dimensions of 63 inches in height and 126 inches in length. Arrangements provide for stacking vertically or horizontally in multiple unit installations. For fluids having various specific heats detailed Btu/hr capacities are available from the manufacturer. Standard construction is hot-galvanized steel surface and casings. Other corrosion resisting metals are also available. Niagara Blower Company is at New York, N. Y.

Vari-Pitch Sheave

COMPACT "Vari-Pitch" sheave which permits wider speed changes and increased horsepower transmitting capacity has been announced by Allis-Chalmers, Milwaukee 1, Wis. The new single-grove "S" section sheave has a range of 5½-in. minimum to 120-in. maximum. Companion sheaves with "Magic-Grip" bushings in sizes from 8 to 24-in. pitch diameter are available along with "S" section belts in lengths from 54 to 150-in.

Globe-Type Needle Valve

DESIGNATED Type N-28, a new globe type needle valve has been introduced by the Kerotest Mfg. Co., Pittsburgh, Pa. for use as a gauge or for metering service in gas, oil, water lines, or other similar uses. It has been developed to provide a high-quality, economical valve for applications where space is a factor and where operating areas are close . . . metal boxes, pressure gauge controls, laboratories, sampling valves, or other uses where a high-pressure, accurately controlled, perfect shut-off valve is required.



New globe-type needle valve

The new valve features a one-piece solid forged carbon steel body with a 12/14 chromium heat-treated stainless steel stem with Teflon packing. Available in sizes of ⅛, ¼, ⅜, and ½ in.

Chlorine Phenol Slimicide Available in Liquid Form

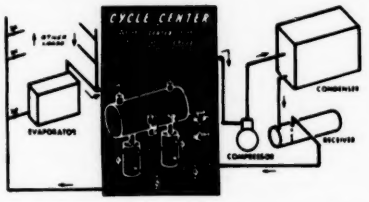
SLIME CONTROL by means of new chlorinated phenolic type agent has recently been announced by National Aluminate Corporation, Chicago. The new product is a highly stable liquid material. Previously the company had supplied chlorinated phenolic type treatments only in ball briquette form.

Known as Nalco 201, the new product is used for general microbiological control in recirculating cooling water systems. It is said to be an effective control for both bacteria and fungi in these systems. (JRT, Question No. 1209, December INDUSTRIAL REFRIGERATION, please take note).

In addition to the active killing ingredient, Nalco 201 contains penetrating and dispersing agents. Reports on the use of the product state that it breaks up protective slime masses and permits the killing ingredients to make intimate contact with the slime forming micro-organism. Technical data available.

Refrigeration Control Unit

NEWLY announced by the J. E. Watkins Company, Maywood, Ill. is its centralized automatic refrigeration control unit called The Watkins Cycle Center. This unit is offered in conjunction with the Watkins program of Pressurized Plants, a program planned to supply liquid to the plant at constant pressure.



A typical Watkins pressurizer plane single stage system

The company states that the Cycle Center combines suction trap protection for compressors with feeding "conditioned" liquid to the plant. The liquid is fed at suction temperature and at constant pressure, regardless of variations in condensing pressure.

Watkins Bulletin CC-1 on the Cycle Center states that large power savings are obtained because condensing pressures are allowed to fall to lowest operable values obtainable from condensers. Further, by feeding subcooled liquid at constant pressure, "solid" liquid having no bubbles of flash gas will be delivered to each expansion valve in the plant, thus providing the feeding conditions necessary for best coil efficiency and improved compressor operation.

The company further states that the liquid "pressurizing" provided by the Cycle Center, when added to the conventional refrigerating cycle, is accomplished at no cost because liquid is "pumped" by flash gas obtained from reducing the liquid pressure to the constant value necessary to feed the plant.

The unit is supplied for any plant system, 8 tons to 1000 tons or over and for any refrigerant. On new plants, first costs are greatly reduced by the Cycle Center design, with maintenance and servicing very much simplified.

Units are manufactured for both single-stage and two-stage systems and for any refrigerant. Further details can be obtained by writing the company for Bulletin CC-1.

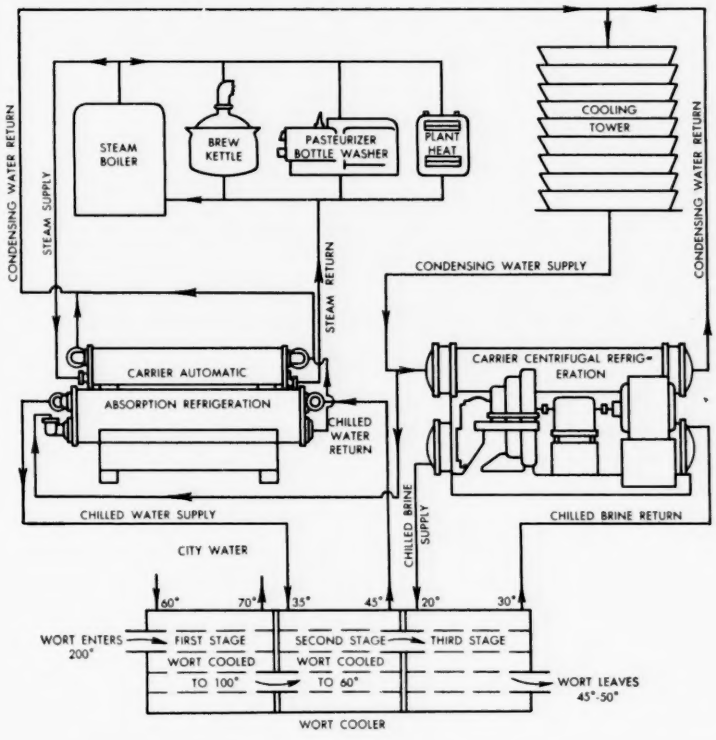
New Synthetic Finish

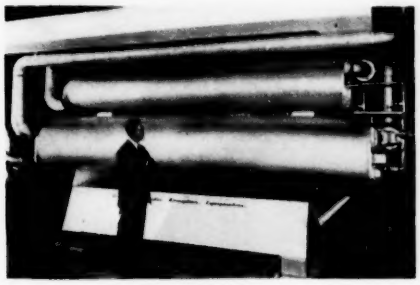
A SYNTHETIC, high-gloss surface finish, "Glazekote No. 77", expressly formulated for coolers, cold storage and food processing areas, fermentation rooms, etc., is announced by O'Neill Floors Company, Cicero, Ill. It is claimed to be mold inhibiting and is deodorized. May be applied over damp surfaces at refrigerated or normal room temperatures. For application by brush, spray or roller over painted or unpainted Fire-Ban, brick, plaster, cement, tile, stucco or wood surfaces. Made in white, may be tinted. Dried to high-gloss washable finish.

HOW CARLING INCREASED REFRIGERATION WITH A CARRIER ABSORPTION MACHINE

To boost its capacity for wort cooling, Carling Brewing Co. of Cleveland selected a steam-operated Carrier Absorption Machine as the most economical, most efficient solution. Here's why: The Absorption Machine required a minimum modification of the existing system. It required minimum space. And it utilized the power of the plant's coal-fired boilers.

How it fits into the system is shown in this diagram. You'll note that wort in the first stage is cooled by city water; in the second stage, by water from the Absorption Machine; and in the third stage, by brine supplied by Carrier Centrifugal Refrigeration. In the winter, when city water temperatures are low, the Absorption Machine is not used. However, when water temperatures hit about 60° F, it goes into operation and runs almost continuously until cold weather. Under peak loads, the system handles slightly over 7000 barrels of wort a day.





Capacities: 60 to 700 tons. Carrier refrigeration equipment has been serving Carling since 1933. At the time the Absorption Machine was added for wort cooling, another was added for air conditioning office areas and cafeteria. Other Carrier equipment at Carling: five Centrifugal Refrigerating Machines and sixty-seven Cold Diffusers.

Carrier Absorption Machines are available with capacities from 60 to 700 tons. They come in single, compact packages for low-cost installation. They operate economically on low-pressure steam or hot liquids, adjust electronically to varying loads and require a minimum of attention.

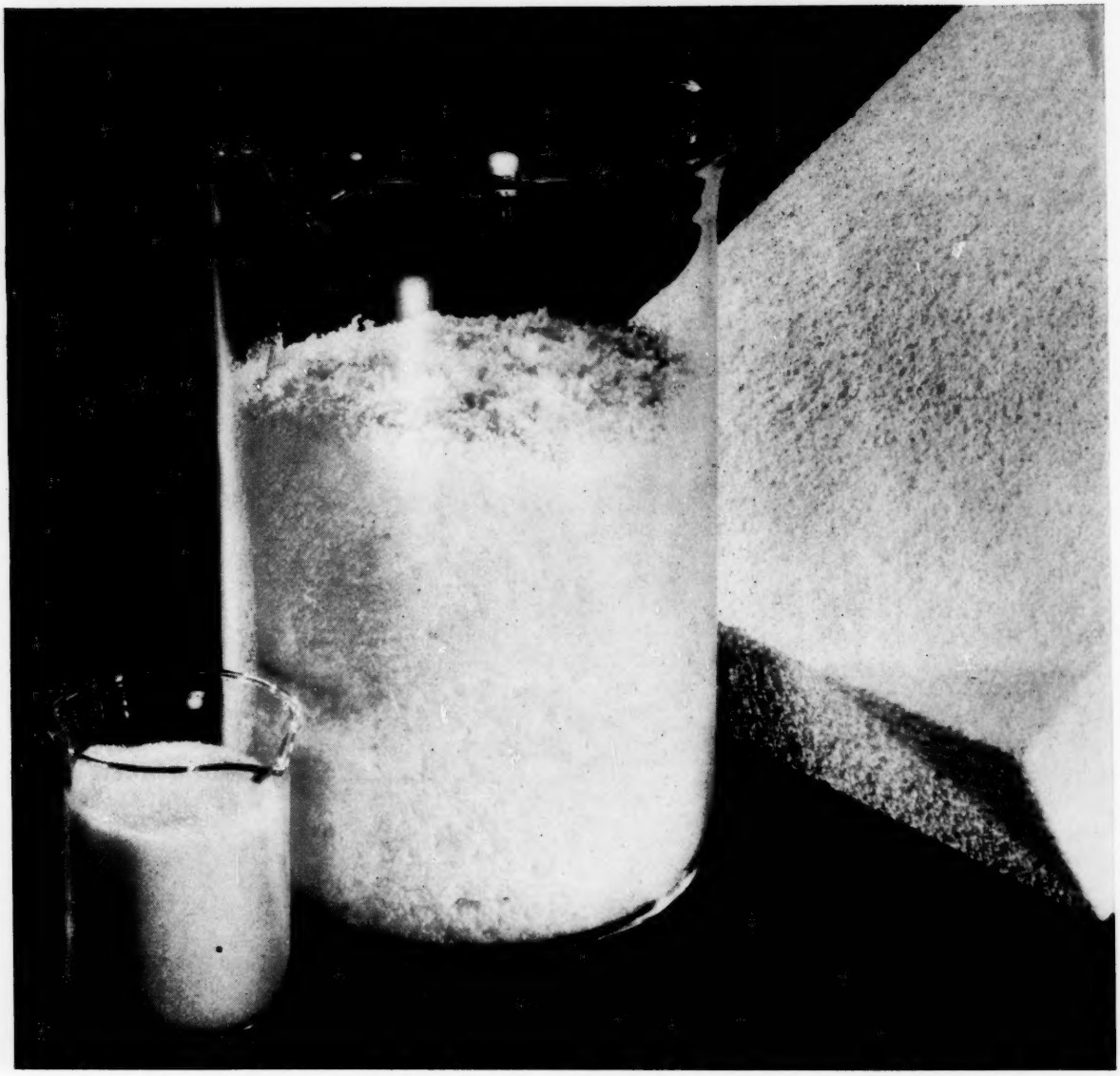
World-wide refrigeration experience. Carrier refrigeration equipment, which serves breweries large and small all over the world, includes Centrifugal Machines, Absorption Machines, Reciprocating Water Cooling Packages, Cold Diffusers and Evaporative Condensers. Each provides unique advantages under special conditions.

With this complete range of equipment, Carrier engineers can recommend impartially the best for your purpose. Good reason to bring your problem to Carrier, whether you need a single machine to increase your present capacity or an entire ammonia refrigerating system. For information, call your nearest Carrier office. Or write Carrier Corporation, Syracuse, N. Y.

Carrier

REFRIGERATING SYSTEMS

CLOSE-UP OF A MODERN COLD ROOM INSULATION



Amazing new Armstrong Armalite*

a lighter, more efficient foamed plastic insulation for cold rooms

This unusually light, extra efficient insulation starts with tiny beads of plastic. They're pre-expanded to forty times their original size, then molded with heat and pressure into strong, resilient boards. Carefully controlled formation produces a closed cell structure that results in the low k-factor of 0.24 at 70° F. mean temperature.

Weight is only 1.25 lbs. per cubic foot, yet this remarkable material has high strength and great resilience. It will "give" under pressure during installation, then spring back to close joints if contraction occurs even at very low temperatures. Other advantages include excellent stability at temperatures from 300° below zero to 175° F., good moisture resistance, excellent handleability . . . all at low cost.

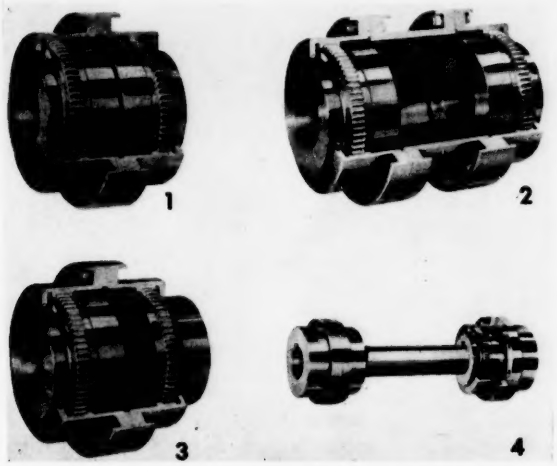
These are just the high lights. For details send today for the free folder, "Armstrong Armalite." Write to Armstrong Cork Company, 2102 Skye Drive, Lancaster, Pa.

*TRADE MARK

Armstrong INSULATIONS

Flexible Coupling Book

GEARED FLEXIBLE COUPLINGS, Book 2775, a completely new 12-page publication by Link-Belt Co., details pertinent application and selection data for couplings with minimum bores ranging up to 7-in., and ratings from 2½ to 572 hp/100 rpm. Packaged components in bore sizes up to 2-3/4-in permit "off the shelf" delivery.



Four types of Link-Belt geared flexible couplings, described in Link-Belt's new book No. 2775, shown above are: (1) SG, for direct-driven industrial equipment; (2) SGE, for connecting shafts that are separated by short distances; (3) SGM, for connecting tapered shafts; and (4) SGS, for shafts that are far apart.

Link-Belt's design of geared flexible couplings provides extra large bore capacity in proportion to outside diameter, transmitting more power, size for size, than comparable couplings. Housing halves are of forged steel solidly joined by hardened and ground socket head through-bolts with lock nuts, arranged for one-tool assembly. Effective quad-ring hub seals retain lubricant and exclude dust, water or other contaminants.

The design provides for reasonable parallel and angular misalignment with a minimum of backlash. Wide faces of internal gear teeth allow end float of connecting shafts while maintaining full tooth contact. For Book No. 2775, write to Link-Belt Company, Dept. PR, Chicago 1.

New Product For Metal Coating

A NEW product, Farrellok, for removal of rust, protection from corrosion, and preparation for paint has been introduced by The Farrelloy Company, Philadelphia, Pa.

It requires no surface preparation (except removal of oil or grease). Its formula removes rust and protects metal in one operation. It combines chemically with metal to form a highly ductile phosphatized coating making for an unexcelled paint base. This ductile non-metallic coating does not flake off even when bent or dented.

It may be used hot or cold with equal effectiveness. Generally speaking heat increases the activity of the formula thereby reducing the time of application. Small parts may need several applications with brush at room temperature before metal is cleaned and coated. It may be used for cleaning alloys of steel, cast iron and zinc base metals and is equally effective on all ferrous metals except stainless steel.

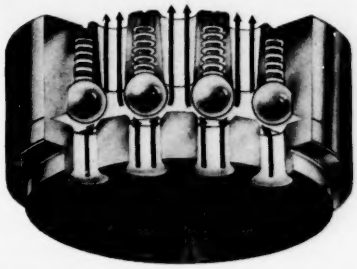
This coating is absorptive of oil as well as paint. The use of an oxidizable oil, such as linseed, gives long time protection from corrosion. It is so balanced that a supersaturation at the surface of the metal is obtained thereby making for a dense but uniform crystal coating, eliminating pitting of the surface and leaving unaffected the tolerance of the metal. It may be applied by dipping, spraying, or brushing, either hot or cold. It is non-inflammable.

PERFORMANCE-PROVED!

New BALL VALVE

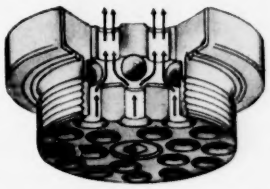
DISCHARGE AND SUCTION VALVES INCREASE THE PERFORMANCE OF ANY COMPRESSOR—OLD OR NEW!

"BV" DISCHARGE VALVES



Actual tests conducted by a leading independent research organization* prove that the New Ball Valve *passes 26% more gas!* In operation, users report amazing increases in performance when they install Ball Valves—and not one report of valve failure or breakage in operation! *Name on request.

"BV" SUCTION VALVES



In the Ball Valve, multiple steel balls replace the flat "plate" or "poppet" — resulting in less resistance, better seating, far greater life and improved performance. New "BV" Standardized Suction Valve Assemblies, available for most compressors, allow complete standardization of your suction valves, regardless of the number of different makes of compressors that you have in operation.

Can Be Installed in 3 Minutes

Easy to install, without drilling or tapping. "BV" suction valves are simply screwed in, then locked in place with special locking ring. Removal for inspection is just as quick and easy.

For information on improving the performance of your compressor, send us the name, bore, stroke, speed and serial number of your machine.

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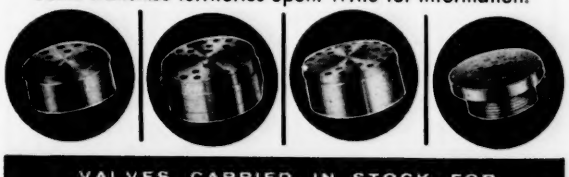

VALVES CARRIED IN STOCK FOR LEADING HEAVY DUTY COMPRESSORS.

It takes practice to do this WELL!

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NATIONAL ***Refrigeration Coils***

Progressive engineering and expert production, smooth bends and skilful welds and accurate measurements delivered . . . this is specialization that *pays off* in lower maintenance, higher efficiency, greater longevity.

Whenever *you* need coils, why not send for our free tracing-chart? It will simplify your specifications, whether for zig-zag or nested box or conical or round-flat or reducing coils. — NATIONAL QUALITY also guarantees effective service in HEATERS, CONVERTERS and HEAT-EXCHANGERS.

NATIONAL QUALITY

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PRESS BRIEFS

Spectacular Fire Destroys Old Refrigerated Warehouse

A SPECTACULAR fire New Years Day destroyed an old cold storage warehouse at 54 East Hubbard Street, Chicago. The building was originally owned by The Monarch Cold Storage Company which was voluntarily liquidated many years ago. The building had not been occupied for several years. The blaze was discovered shortly after 7:00 a.m. on the second and fourth floors of the seven story brick structure, 50 by 150 feet. Ten hours later Robert J. Quinn, fire commissioner, pronounced it under control.

Fire officials said the old insulation in the building's thick walls likely would be burning and smoldering for two or three days. Wednesday night heavy smoke continued to pour from the structure. Firemen theorized the fire started when a vagrant built a fire to keep warm in the sub-freezing temperatures. There have been several small fires in the place in recent years, presumably started by vagrants who went into the place to sleep.

The brick exterior walls were 22 inches thick, with 12-18 inches of insulation. The fire smoldered for several days, making it necessary to keep a large force of firemen and fire fighting equipment on duty. A large crane was taken to the scene to batter holes in the walls at several places so the water could reach the burning ruin. Eventually the building was demolished at a cost of $20,000 to the city. It was not insured.

New Refrigerated Service for Pacific

REGULAR 7-weekly refrigerated cargo service between New Zealand, Japan and other Pacific area destinations will be established in February, conference lines handling the New Zealand-United Kingdom trade have announced. A new company, to be known as the Crusader Shipping Co. Ltd., is being formed to operate the service, and a new motor vessel, the Crusader, has been purchased from the builders by the proprietary lines—New Zealand Shipping Co. Ltd., Shaw Savill & Albion Co., Ltd., Port Line, Ltd., and Blue Star Line, Ltd.

The Crusader is a fully refrigerated motor vessel of a total deadweight capacity of 3,300 tons, measures 408 feet 9 inches in overall length, and has a refrigerated cargo capacity of 220,000 cubic feet. Its trial speed is likely to be about 18 knots, which will give it a service speed of approximately 17 knots. The vessel is intended to maintain a regular service beginning in February.

Quincy Market Splits Shares

QUINCY Market Cold Storage & Warehouse Co. of Boston voted to split the shares two for one and also declared a stock dividend of 1½ shares for each of the newly split shares, or in effect, a five-for-one split overall. The split became effective December 26 and the stock dividend was payable on that same date. The action will increase the number of shares outstanding from 14,500 to 72,500.

Directors declared a cash dividend of $1 a share, payable December 31, to stockholders of record December 26, on the shares outstanding after the two-for-one split, but before the stock dividend. The cash dividend is the equivalent of $2 on the old shares, unchanged from the $2 paid in previous quarters.

Get Your HIGH-PROFIT Share of the $20,000,000 ICE CUBE BUSINESS

with this G-W Automatic Cuber!

According to statistics published by the National Association of Ice Industries in June, 1957, ice-cube prices average approximately 300% higher than prices of all types of ice combined. Compared with sized and crushed ice, cube prices are more than double—*and going up faster than any other type.*

You can easily cash in on this high-profit ice cube market—or increase your present ice-cube volume overnight—with Gifford-Wood's remarkable Type CA Cuber.

Fully automatic, the G-W Type CA Cuber converts 300 to 400-lb. cakes into cubes at a rate of *26,000 cubes an hour.* Firm cake alignment assures square, attractive cubes. When cake is 75% cubed, the next cake slides easily into position. Every part of the cuber that touches ice is completely corrosion-resistant and ruggedly built for *years* of trouble-free service.

● **The Big Profits** from your ice-cube sales will quickly pay for your new G-W ice cuber.

● **Low-Cost, Reconditioned** G-W cubers perform like new and make ideal supplementary equipment—to increase your present cube volume.

● **Easy, 24-Month Payment Plan,** plus a generous trade-in allowance on old G-W cubers, can help you boost your profits *right now!* Call your ice-wise G-W representative for further details, today! ⊕ 4246

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☐ Send me your Bulletin on G-W Cubers.

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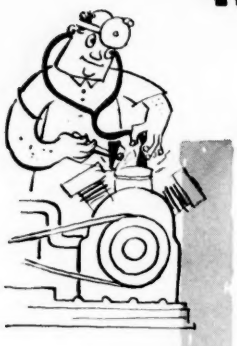


If your answer is NO... or DON'T KNOW—

How did your refrigeration stack up last summer? If there were any weak spots in your set-up, right now is the time to get your plans set for the coming season, so it can't happen again.

Here are some things to look for:

Have you enough compressor capacity?

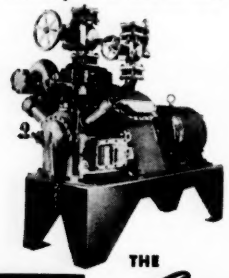
Will you get the temperatures you need in your milk room—your hardening room?

Have you sufficient ice-builder capacity for best economy?

Can you depend upon your compressors—or will you be taking a chance on breakdowns and high repair costs?

Can you freeze as many novelties as you can sell?

If the answer is *no*—or *don't know*—to any of these questions, it will be well worth your while to have a CP Refrigeration Engineer sit in with you, now. Then you and he can determine how you can meet your needs most exactly and economically.



Whether it's a Compressor, or Booster—an Ice Builder—a hardening tunnel or a completely engineered Refrigeration system, CP can provide what you need, economically and with satisfaction assured.

THE MARK OF DISTINCTION IN REFRIGERATION EQUIPMENT

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New Cold Storage Plant for Grapes

A NEW cold storage plant covering an area of 300 x 60 feet has been completed at Delano, Calif. for Irving Goldberg & Sons, packers and shippers of grapes, at a cost of $60,000. Remodeling of the packing section cost an additional $25,000. The new storage facility holds 25,000 lugs of grapes and is cooled by ice costing $10,000 a year. Each of the two cold rooms is equipped with four fans, and there is also a gas room where fruit is sprayed with a preservative.

During the last season approximately 750,000 lugs of juice and table grapes were shipped, according to Irving Goldberg. Associated with him in the business are his sons: Jerry, Donald, Fred and Alvin. Walls and ceiling insulation plus a special vapor barrier maintains humidity to preserve the stems. This, according to Goldberg, keeps the fruit fresher, so that it will bring a higher price on the off-season market. He estimates that it costs 12 cents per lug per month to keep the grapes in storage until the market is most favorable. Through the last season approximately 750,000 lugs of juice and table grapes were shipped.

Explosion Damages Storage Plant

AN EXPLOSION crumpled two sections of 18-inch-thick walls of a cold storage plant at Richmond, Va. operated by the Merchants Ice & Cold Storage Co. It spilled tons of bricks onto employees and customers and smashed windows for blocks. Three bodies were removed from the wreckage. Four other persons were missing and feared dead beneath the rubble.

Police Chief O. D. Garton said four employees of the company and four persons who had backed trucks up to the building to pick up frozen foodstuffs were believed dead. It was believed that the blast was caused by escaping ammonia fumes. Rescue operations were hampered by lingering fumes and the danger of another collapse. There was little hope that any of the missing men could have survived the blast, but rescurers worked into the night.

After the explosion, the plant filled with fumes, and a cloud of ammonia rose across the surrounding neighborhood, on the edge of the downtown business district.

Electricity Used For Freezing Not Taxable

IN A recent ruling an Iowa Supreme Court exempted from the state's two percent sales tax electric power used by a cold storage plant for freezing. The decision held that food freezing constituted "processing tangible personal property ultimately sold at retail". Iowa exempts from the tax electricity used for this purpose.

According to NARW records 20 states levy a sales tax on electric power, but only four—Iowa, Maryland, New Jersey and Rhode Island—have an exemption for electricity used for processing or manufacturing. Whether or not freezing is included under this exemption is a matter of local interpretation or administrative decision. —NARW QUICK SHEET.

Inspection of Poultry

ALTHOUGH compulsary inspection of all poultry and poultry products moving in interstate or foreign commerce does not begin until January 1, 1959, USDA will begin voluntary inspections at government expense May 1. Public Refrigerated Warehousemen are not affected until January 1, 1959.—NARW QUICK SHEET.

In the Spotlight

RED OWL STORES, Inc., last Fall closed their produce center in Minneapolis when the new produce and frozen food storage warehouse addition at Hopkins was completed. This upper midwest operator of 200-odd retail grocery outlets now warehouses and distributes its own perishables from that point to Minnesota and Wisconsin points. A two-stage plant with liquid recirculation, plus a single stage air conditioning system, supplies the firm's 150 TR requirements. See page 13 for story.

HOW TO MEET competition with service ideas is discussed in a report issued recently by the warehouse operations committee of The National Association of Refrigerated Warehouses. The report tells how to repair concrete floors and describes a mobile blast freezer operation by an eastern warehouse. For summary of this report see article on page 20.

COMFORT COOLING has popularized the term "air conditioning" to such an extent that refrigeration is often thought of synomymously. However, refrigeration does not play, as yet, its largest role in air conditioning applications. According to Guy R. King, author of *Basic Refrigeration*, refrigeration's paramount usefulness is still in food preservation. His address to the 48th annual NAPRE meeting is abridged, starting on page 16.

HEAT FLOW through rock to underground storages can now be estimated with reasonable accuracy. Theoretical analysis backed up by several actual research applications have proven the reliability of National Bureau of Standards figures. For a summary of the project conducted for the U.S. Army, see page 21.

PRACTICAL Engineers and management in industries employing lower temperature industrial refrigeration know that multi-staged refrigeration systems are more efficient. However, few really have looked into the "Why" for this efficiency. Realizing that an answer couched in everyday terms would be welcome by industry, the Technical Department of INDUSTRIAL REFRIGERATION and the NAPRE Educational Committee persuaded Professor W. F. Stoecker of the University of Illinois to present such a paper at the 48th Annual Meeting of NAPRE last November. To obtain a better understanding of heat and flow balances that occur within a refrigerating system, and the advantages gained by multi-staging, see page 25.

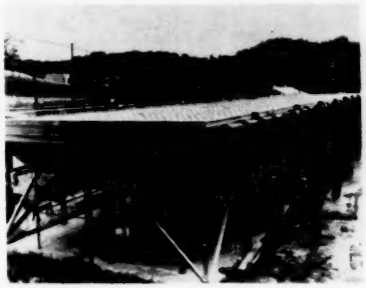
REFRIGERATED Warehouse Companies in New York are opposing lease of city-owned cold storage space in the Bronx Terminal Market. It is claimed that this practice constitutes "'disastrous" competition for private cold storage facilities. On March 11, it was stated by counsel for the group, they had asked Mayor Wagner to close down the facility, claiming that the city was renting the facility so low that the lessee had been able to sell the space at prices substantially under those which private facilities could charge. For news report on this situation see page 34.

PLANT SANITATION in refrigerated warehouse was covered in a recent bulletin issued by the National Association of Refrigerated Warehouses. This bulletin is reviewed in article on page 38.

AN OUTDOOR frozen food vault has been installed by a Virginia Wholesale Grocer. For description and picture see page 18.

Cover Creates Comments

SELDOM does a cover provoke written comment of a nature as those received concerning the December 1957 INDUSTRIAL REFRIGERATION. A number of letters reached the publisher, all inquiring about the row-like apparatus atop the Fluid Cooler which was pictured.



Reduced photo of December Cover Industrial Refrigeration

Manufacturer of the equipment was contacted and a representative of the firm reported the row-like apparatus to be actually small metal arms connected to shutters for the modulation of air flow over the coils. The rods connecting these arms merely serve as stringers. The shutters are used as an additional aid to capacity control of the Fluid Cooler. The principal method of capacity control is the control of the fans' output, which, in turn, are controlled by the speed of the motor drives.

The shutters are pneumatically operated. The piping noted along the side of the Fluid Cooler is the coil manifold. It will be noted that the main pipe is fed at intervals from piping which appears to be rising out of the ground. This is actually the case, as this piping is connected underground with the reactor tank. The hot water coming from the reactor flows through this pipe, and then into the coils where it is air-cooled and finally returned to the reactor, thereby completing the cycle. The white reflection is that of the sky on the surface of the shutters.

OUT OF two million Federal employees, about seven percent or 142,000 were engaged in research, development and related activities in 1957 according to figures released by the National Science Foundation. Of these, approximately 37,000 were scientists and engineers; the remainder were supporting personnel.

"What do you mean ...your partner?"

...I ALWAYS THOUGHT YOU WERE SOLE OWNER OF YOUR REFRIGERANT BUSINESS, ED.
I AM, TOM...
...AND I'VE BUILT IT INTO A NICE BUSINESS--- YOU SEE, I'M A LOCAL DISTRIBUTOR AND SO I'M ABLE TO OFFER MY CUSTOMERS DEPENDABLE DELIVERY AND PERSONAL SERVICE...

...AND HERE'S THE PARTNER I SPOKE OF... BARRETT BRAND CYLINDER AMMONIA.
WHAT'S SO SPECIAL ABOUT IT?
"IT'S THE PURITY, TOM. AT THE NITROGEN DIVISION PLANT THEY TEST EACH CYLINDER FOR PURITY, AND EACH VALVE FOR TROUBLE-FREE OPERATION."
SO YOU SEE, TOM---I SUPPLY THE SERVICE... BARRETT AMMONIA SUPPLIES THE PURITY. TOGETHER WE'RE ABLE TO OFFER YOU BETTER AMMONIA SERVICE!

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Miami: Columbia Chemical & Supply Co., 7420 N.E. 4th Ct. P. O. Box 967
Tampa: Food Equipment & Supply Co., 1809 2nd Ave. P. O. Box 422

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Macon: The Anderson Chemical Co., Inc., 1620 Waterville Rd. P. O. Box 1424

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Centralia: Kem-I-Kal Engineering Laboratories, Inc., Pearcy & Broadway
Chicago: Westland Engineering Supply Co. 53 W. Jackson Blvd.

INDIANA
South Bend: Mid-Continent Chemicals, Inc. 2217 So. Main St.

IOWA
Burlington: McKesson & Robbins, Inc., West Central District Off. 100 N. 4th St. P. O. Box 591
Cedar Rapids: McKesson & Robbins, Inc. Cedar Rapids Div., 900 2nd St., S.E.
Ottumwa: J. W. Edgerly & Co., 120 W. Main St.
Sioux City: McKesson & Robbins, Inc., Sioux City Div., 308 Pearl St.

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Louisville: Griffin Chemical Co., 528 Franklin St.

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New Orleans: Sam Reisfeld & Son, 649 South Galvez St.
Shreveport: Thompson Hayward Chemical Co., 219 Beech St.

MAINE
Portland: Acme Engineering Co., 46 Market St.

MARYLAND
Baltimore: Leidy Chemicals Corp., 920 S. Eutaw St.

MASSACHUSETTS
Attleboro: Reynolds & Markman, Inc., 88 Union St.
Springfield: The Chemical Corp., 54 Waltham Ave.
West Springfield: Barker Chemical Co., 101 Circuit Ave. P. O. Box 173
Worcester: Brewer & Co., Inc., Ind. Chem. Div., 45 Arctic St.

MICHIGAN
Detroit: Eaton Chemical & Dyestuff Co., 1490 Franklin St.

MINNESOTA
St. Paul: Lyon Chemicals, Inc. 2395 Hamsden Ave.

MISSOURI
Kansas City: Abner Hood Chemical Co., 507-517 N. Montgall Ave.
St. Louis: Nitrogen Div. Allied Chemical & Dye Corp., 4528 South Broadway
St. Louis: McKesson & Robbins, Inc., Chemical Div., 904 Landreth Bldg., 320 N. 4th St.
St. Louis: G. S. Robins & Co. 126 Chouteau Ave.

NEBRASKA
Omaha: McKesson & Robbins, Inc., Omaha Div. 902 Farnam St.

NEW JERSEY
Edgewater: Nitrogen Div. Allied Chemical & Dye Corp., 1 River Road
Paterson: Lotte Chemical Corp. 109 5th Ave.
Paterson: Seaboard Industries 195 Keen St.
Paterson: Wollen Chemical & Supply Co., 126 6th Ave. P. O. Box 1659

NEW YORK
Albany: Albany Laboratories, Inc., 67 Howard St.
Bklyn: Tex-Ite Products Corp. 555 Park Ave.
Buffalo: Commercial Chemicals, Inc., 211 Hertel Ave.
East Syracuse: Gleason Materials & Equipment Co., Inc., 130 Headson Drive.
New York: Nitrogen Div. Allied Chemical & Dye Corp., 40 Rector St.
New York: N. H. Heyman, Inc., 168 E. 91st St.
New York: E. M. Sergeant Pulp & Chemical Co. 7 Dey St.
Poughkeepsie: Duso Chemical Co., Inc., Fulton & Fairview St. P. O. Box 665
Rochester: Wm. B. Duffy Cutting Co., 62 Scio St.

NORTH CAROLINA
Charlotte: American Cyanamid Co., 3333 Wilkinson Blvd.

OHIO
Cleveland: Harshaw Chemical Co., 1945 E. 97th St.
Cincinnati: Merchants Chemical Co., Inc. 2933 Spring Grove Ave.
Toledo: Ohio Inland Chemical & Solvent Corp. 1775 Dorr St.

OKLAHOMA
Okla. City: Rex Engineering & Sales Co., 2735 N.W. 10th St. P. O. Box 5141
Tulsa: Vaughn Chemical Co. 1102 E. 3rd St.

PENNSYLVANIA
Altoona: Western Pennsylvania Chem. Co., Inc., 4125-41 6th Ave. P. O. Box 703
Avoca: Lunox Chemical Works, Inc., Box 7
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Produce and Frozen Food Facilities Housed In New Red Owl Warehouse

DALE A. WEUM

RED OWL STORES, Inc., an upper midwest grocery chain, found it necessary in 1957 to build a new warehouse for produce and frozen food. Management selected V. J. Winter, Assistant Vice President, who was at that time in charge of Red Owl warehouse operations, Hopkins, Minn., to make a study and plan the new addition.

Efficient Layout and Floor Plan Designed

After inspecting similar phases of many grocery chains and by combining this with his experience of operating warehouses, Winter determined the most efficient layout with regard to materials handling, present volume and projected volume of frozen food and produce. Numerous conferences were conducted among the warehouse, retail and engineering departments. With the combined information, a floor plan was developed. This plan was relayed to the architects, Lang & Raugland, Inc.

Because of Red Owl's rapid expansion (the building of retail stores and resultant need of capital for that purpose), it was imperative in all phases of planning to determine methods of acquiring at least expenditure the greatest amount of building space and equipment. Red Owl engineers, having the experience of engineering and operating refrigeration plants in similar buildings, proceeded to develop plans for the installation which would result in the most economical operating practice and the least costly equipment installation.

Dale A. Weum is Company Engineer for Red Owl Stores, Inc.

TABLE 1 — Three-temperature-level refrigerating system services produce and frozen food applications at Red Owl store's warehouses, Hopkins, Minn.

	Areas		System	
Application	Tons	Temp., °F	Suct., psig	Temp., °F
F.F. Storage	24	−5	6	−15
Ice-Maker	7	0		
Bake Freezer	6	10		
Dough Chiller	18	10		
Prod. Cooler	20	35	35	21
Banana Rooms	15	55		
Air Cond't'g	55		55	37

See Also Fig. 1.

Expand Existing Engine Room

Location of an ammonia compressor room in the basement of the grocery warehouse was adjacent to the area planned for the new building. Therefore it was decided to enlarge that engine room for additional equipment. Also an advantage could be gained in that the present equipment could be used in combination with the new equipment. The existing plant consisted of 6 x 6-in and a 4 x 4-in NH_3 compressors, shell-and-tube condenser and receiver.

Space was available in the grocery warehouse basement for expansion which would house the additional equipment, and a new electrical transformer. Water was also available at that point.

Estimated New Plant Loads

Refrigerated loads were calculated for frozen food freezer, ice maker, bakery freezer, dough chiller, produce coolers, banana rooms and in air conditioning of the produce assembly and frozen food assembly area (see Fig. 1). Three suction temperatures and/or pressures were chosen as the most ideal for compressor operation. They were as shown in Table 1.

A study of different size and types of compressors indicated that a multiple of medium sized, heavy duty, industrial, ammonia compressors was the most advantageous. High efficiency of operating compressors fully loaded could be accomplished by varying number and sizes of compressors with the fluctuating load. Larger compressors with unloading devices become comparatively less efficient as loads decrease. The cost of larger compressors and accessory equipment was approximately the same in relation to comparative tonnage compressors of similar size.

Piping to a multiple of compressors was somewhat greater cost but this was considered a small investment to gain the advantage of flexibility for transferring compressors from one

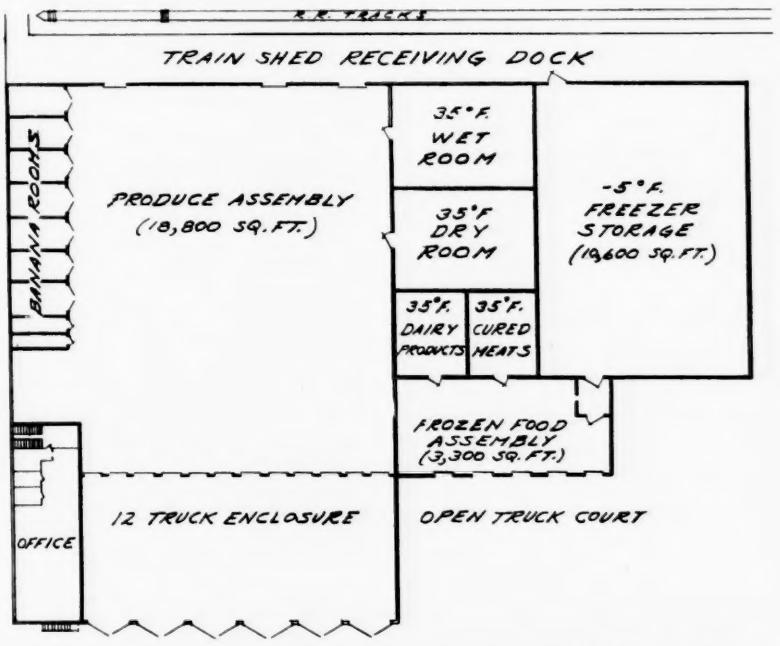


Fig. 1 — Plan of Produce and Frozen Food Warehouse addition to Red Owl Stores, Inc., offices, grocery warehouse and operational facilities now located at Hopkins, Minn.

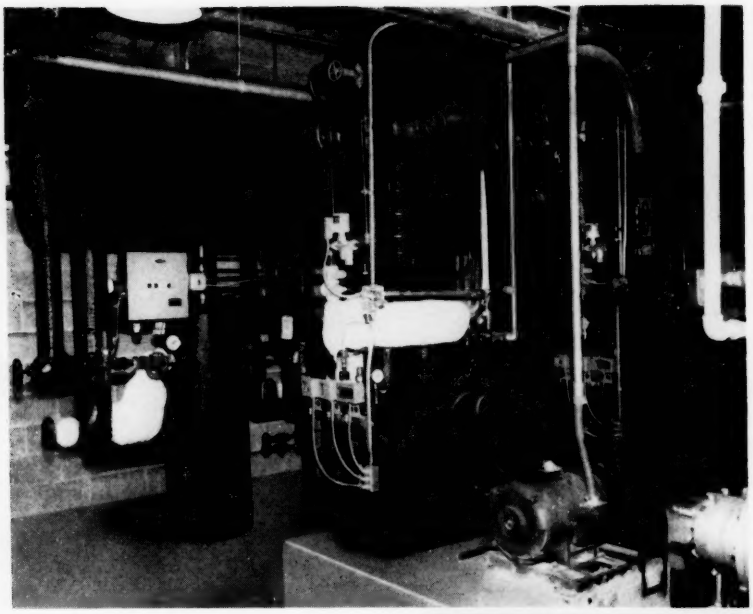


Fig. 2—Two booster compressors pictured in right foreground remove gas from low temperature side of two-stage system. At left is the Watkins Recirculator, Control Center, and Pumper Drum, which provide liquid NH_3 circulation to all evaporative surface except banana rooms.

load to another as demands warrant; to have safety factor in numbers; compartively less maintenance; and, as stated, a greater average efficiency.

Plant Air Conditioning Load

The existing 6x6-in and 4x4-in compressors would deliver 55 tons at 55 psig suction and 118 psig head pressure, which took care of air conditioning loads. This was 1.6 tons/bhp.

Two 7¾-in x 5-in booster compressors delivering 56 tons at 6 psig suction pressure and 35 psig discharge were ample for all low temperature loads (see Fig 2). One compressor is driven by a two speed motor.

Four 6x6-in compressors (see Fig. 3) delivering 108 tons and operating at 35 psig suction pressure and 118 psig condensing would handle cooler and booster discharge loads. This is 1.2 tons/bhp on cooler loads and .625 tons/bhp on freezer loads.

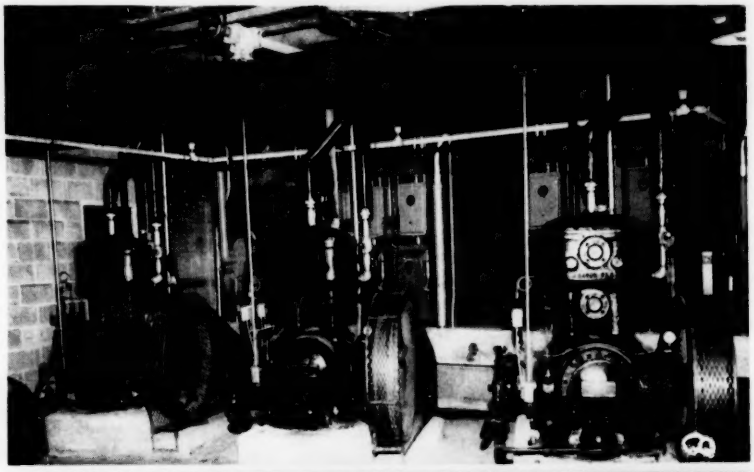
Recirculator Selected

By adding a Watkins Recirculator and Pumper drums on both the high and low stages (see again Fig. 2), it was not necessary to have pumps, floats or automatic expansion valves with their inherent maintenance problems, in the system. By using fully flooded evaporator coils, these surfaces were reduced approximately 20 percent in relation to normal practice.

Gravity finned pipe coils mounted in the joist space were used in the produce cooler. Produce and frozen food assembly was air conditioned, using suspended air handling units.

Red Owl had experienced losses of bananas due to leaks of ammonia in another plant. Therefore, in this installation, a shell-and-tube NH_3 chiller was planned. Ethylene Glycol and water as a brine solution was circulated through air handling units for cooling the banana rooms (see Fig. 4). Ripening through heating was by steam with a coil in same air handling units.

Unfavorable experiences of using blower coils in previous installations, such as discomfort of personel working in the space, dehydration of product, added refrigeration load resulting from fan motor heat, and the added electric power cost of operating the fan motor and additional compressor



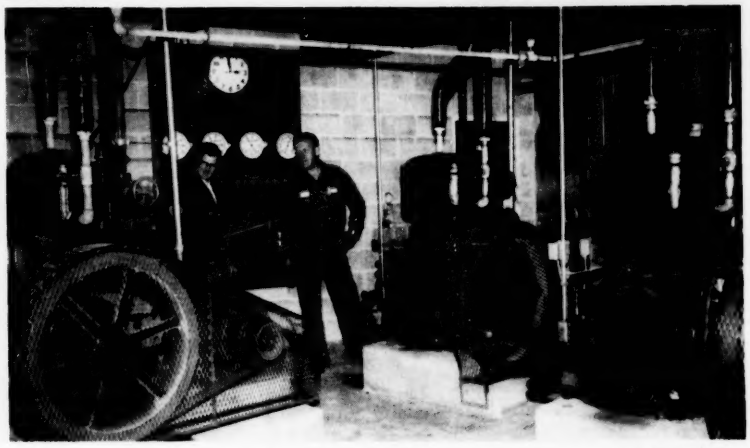


Fig. 3 — Two views of the four high-stage compressors serving the booster discharge and high temperature portion of the two-stage plant. At top are three of the VSA twin-cylinder machines, while the fourth unit (in bottom photo) is apparantly topic of conversation for the refrigeration contractor and company engineer. Two existing compressors were used single-stage for assembly area temperature conditioning.

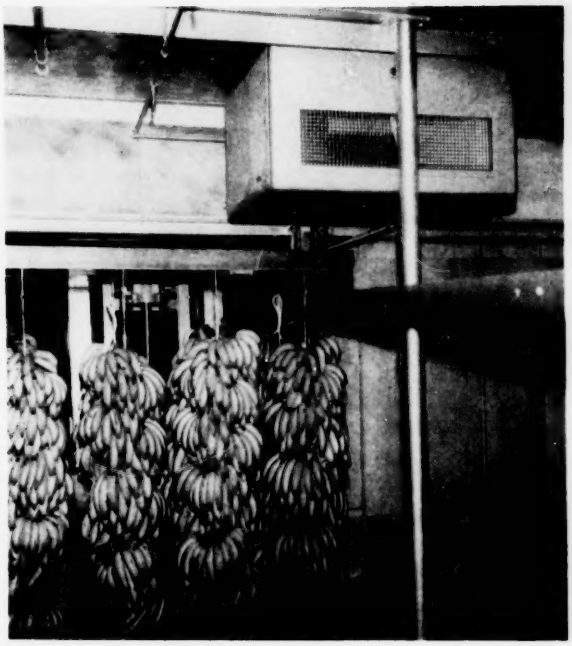


Fig. 4 — Closeup view of ethylene glycol refrigerated air circulating unit typical of each banana room. A steam coil is built into each unit for ripening purposes. Bananas are placed on 8-stem spreaders for double-decking and rapid handling by fork-lift trucks. Exterior view of a banana room loading operation is pictured on the Cover. Fig. 1 pictures the battery of eight banana storage and ripening cells; the Cover picture, their exterior.

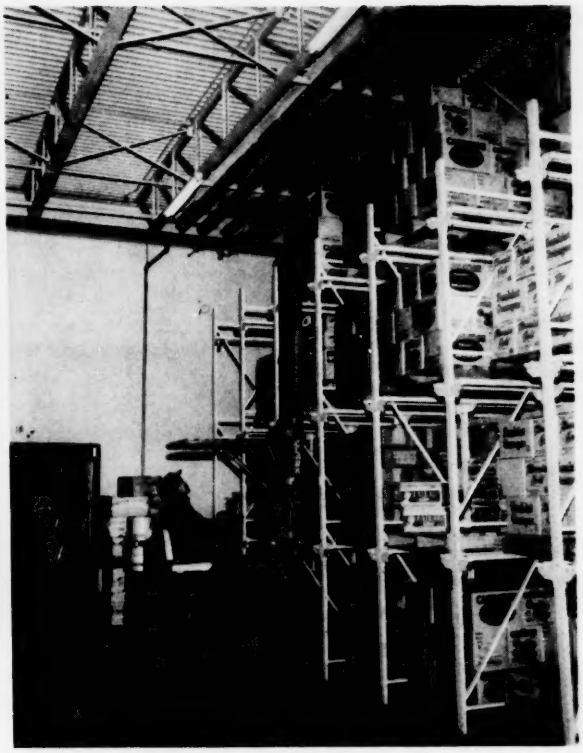


Fig. 5 — Finned pipe located directly above truck's telescoping lift, provides gravity cooling for this dry produce storage. Access to the room is via double flexible rubber auto-close doors.

equipment, influenced the selection of gravity coils such as pictured in Fig. 5, whenever possible. Had fans been used throughout all rooms, the added refrigeration load would have necessitated one additional compressor.

Well water at 50F was used to air condition offices, store and cafe. This water leaving air conditioning coils at 55F was re-used through the shell-and-tube condensers for the ammonia system. During the winter, water is circulated between the condensers and a 100,000 gallon outside sprinkler water storage tank; a very satisfactory combination of heating tank water and cooling condenser.

Gartner Refrigeration & Mfg., Inc., Minneapolis was the successful bidder and made a very satisfactory installation of equipment all in accord with specifications. Being upper midwest Frick factors, they used Frick compressors, gravity coils, air handling units, condensers, and receivers, plus the Watkins recirculating system and Refrigeration Specialty Co. controls, for this installation.

Insulation and Doors

The building was planned with a great deal of care to utilize every cubic foot of space to expedite material handling. Insulation was placed on top of roof decking so that joist space was available for sprinkler, steam, and refrigeration piping, and refrigeration pipe coils. Air handling units were suspended and the glycol chiller for the banana rooms was mounted above one of the rooms. Rubbair double swinging doors were used in higher temperature rooms throughout the building, with wood panel overhead doors instead of insulated refrigeration doors as normally used. On the freezer, a motorized insulated door was installed. Banana rooms were equipped with Jamison double Vap-R-Tyt doors.

With the opening of this produce and frozen food addition, Red Owl has consolidated under one roof 550,000 square feet of floor space devoted to home offices, bakery, coffee roasting, cabinet shop, grocery retail store, cafeteria, grocery warehouse, and produce and frozen food warehouse. On August 18, 1957, as the first palletized load of grapes was decked approximately twenty feet in the air in one of the new coolers, workmen were still completing final construction work in other areas of the warehouse. A meat commissary is included.

Simultaneously with the opening of this mammoth structure, which will serve nearly 200 corporate and agency stores, the company's old produce warehouse at 905 N. Fifth St. in Minneapolis closed its doors for the last time. This much smaller operation had served the company since 1933, until January 1, 1956 as the Lakeland Fruit and Produce Company, a wholly owned subsidiary of Red Owl. Produce office personnel, plus the produce warehousemen who also moved to Hopkins at the same time, brings the total number of people employed in the Hopkins plant and office to over 800.

New Precooling Plant

THE Refrigeration Service Co. of Denver, owned by Fred and Ed. Hosken has opened a $100,000 precooling plant for Lower Rio Grande Valley lettuce and cabbage. The firm also operates plants at Lockney, Henderson and Yampa, Colo. The plant will utilize the vacuum cooling principle which has been in successful use for some time and has proven to be particularly effective for leafy vegetables.

By Guy R. King

NAPRE's Educational Vice Chairman, Guy R. King, is an instructor at Santa Monica City College, Santa Monica, California. He had many years of practical experience in Northern California before becoming an instructor in refrigeration at a San Francisco trade school. While at San Francisco, he served as instructor for California Chapter No. 1 of NAPRE. He also served several terms in similar capacity in the Honolulu Trade School, returning to the mainland for a position in Santa Monica. He is author of the text "BASIC REFRIGERATION", the official NAPRE text.

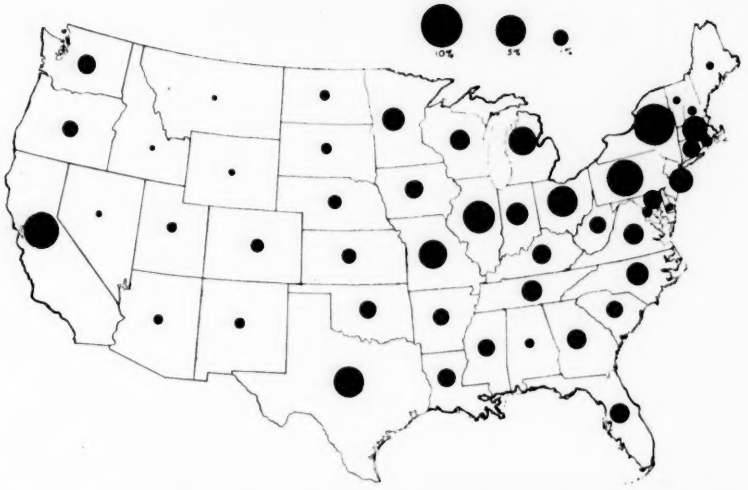


Fig. 1 — Over half the U. S. population resides East of the Mississippi River, creating food preservation problems directly interlocked with the marketing and distribution of edibles. This map pictures population concentrations. Only one of the six most populated states (California) grows sufficient fruits and vegetables for its populace.

FOOD

From Farm To Family Table Is

Refrigeration's Most Important Role

What is the biggest single use of refrigeration? Is it air conditioning? Is it in the chemical industries? Is it for stratosphere test chambers? Greatest use of refrigeration is none of these. Preservation of food products is the greatest use of refrigeration.

Does this sound like a daily, humdrum business; which hasn't changed for the last fifty years? The amount of food being refrigerated is constantly increasing. Methods of applying refrigeration to food products are also being increased. Think of the increase in use of frozen foods in the home since World War II. Think of the increase in frozen precooked food in the last few years.

Every individual working in food refrigeration should know and appreciate the importance of his work, not only in our daily economy, but in our daily well-being. He should be proud of being a part of an industry which has done, and is doing so much to help make the American people the best fed people in the world. It is hoped that in a world where over half the population is hungry or underfed most of the time, the importance of proper food preservation and distribution methods can develop to the advantage of both the hungry people and the refrigeration expert.

Two Factors Promote Refrigeration of Food

The large amount of refrigeration needed in this country for food preservation comes from two facts. First, the food is not grown where it is consumed. Second, most of fresh foods are produced only a few months of the year; but the nation naturally has a year round appetite.

Consider the first point. An average person will eat about three and one-half pounds of food a day. This means a city of one million people must have available three and one-half million pounds, or 1750 tons of food every single day. This amounts to about 100 freight cars of food that must be brought into the city each day; the exact amount depending on the distance from production areas, time of year, and food habits.

From half to three quarters of this food must be refrigerated at some stage. This does not include the food that is wasted or spoiled. So, somewhere near 75 carloads per day of refrigerated foods are necessary per million people. By boat, rail and truck, New York City brings in over 500 carloads of fresh fruits and vegetables per day. Chicago brings in over 200 carloads per day.

Over half the population of the United States lives east of the Mississippi River (see Fig. 1). But nearly half the vegetables and nearly three-quarters of the fruit is grown west of the Rocky Mountains.

Citrus From Five States

California produces nearly all the lemons, 94 percent of the grapes, 90 percent of the plums and 50 percent of the peaches grown in the country Florida and California together account for all the avocados (Fig. 2)[1], 98 percent of the oranges and 90 per-

[1]See also Table 1 for key to graphs on Figs. 2, 3, and 5.

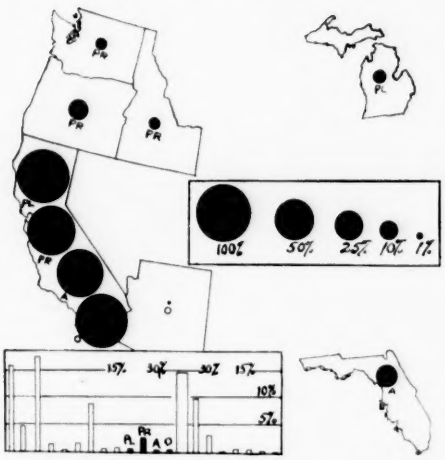


Fig. 2 — Origins of plums, prunes, avocadoes, and olives, by states; their relative quantity (%) to the total fruits and nuts grown in U. S. Although one state dominates, it is very apparent that the four fresh fruits shown here involve great mileages to reach markets.

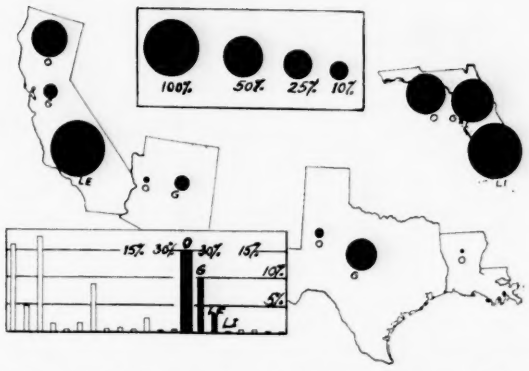


Fig. 3 — Origin of citrus fruits is even more limited geographically (five states), although it quantitatively makes up more than one-third of the total fruits and nuts produced (Note that oranges alone make up nearly 30% of this classification).

an NAPRE Educational Paper

cent of the grapefruit (Fig. 3). Florida produces all the limes.

Washington and California together grow nearly all the apricots, and a third of the apples. With Oregon, these three states produce 80 percent of the pears, 75 percent of the sweet cherries and 50 percent of the strawberries.

California and Arizona account for 65 percent of the cantaloups (see Fig. 4); and the four states of California, Texas, Florida and Georgia, about 65 percent of the watermelons.

Nutmeats are produced from crops in states bordering north of the 30th parallel, with exception, of course, of California (See Fig. 5).

Massachusetts and Wisconsin supply 80 percent of the cranberries.

Imports Add to Food Variety; Add to Reefer Enterprises

Besides produce grown in this country, the United States imports substantial amount of avocados, pineapples and bananas from other countries. Large enterprises have been built up around such imports. The

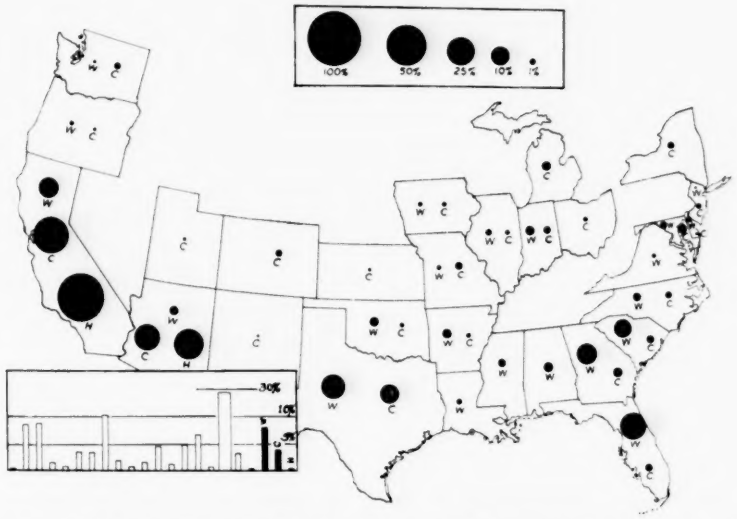


Fig. 4 — Melons grow generally very well in 29 of the 48 states. However, the six most productive states in watermelon and cataloupes are hundreds of miles (two of them thousands) from the population centers. Rapid refrigerated transportation is a must for all but localized marketing.

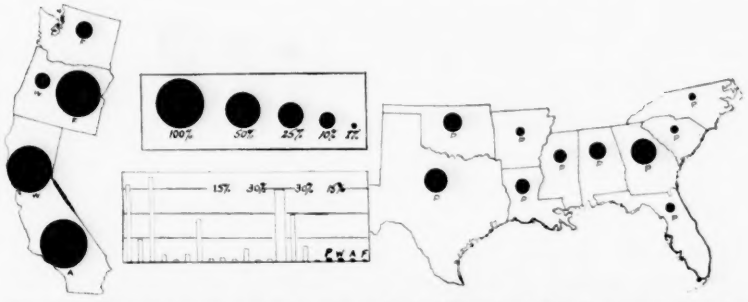


Fig. 5 — Four (pecans, walnuts, almonds & filberts) of the five most popular nuts grown in the United States, choose Dixie and Pacific slopes for their native habitat. Making up less than four percent of the total fruits raised, they are never-the-less a large distribution problem, involving refrigerated storage.

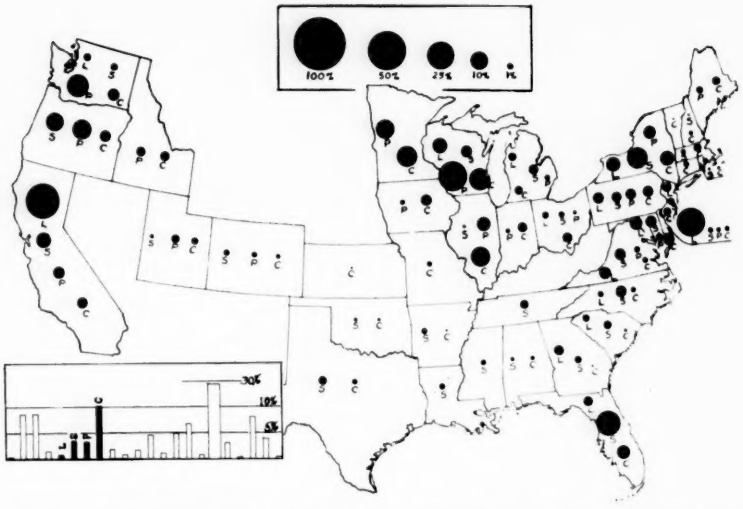


Fig. 6 — Seed vegetables, like limas and string beans, peas and sweet corn have a widely diversified growing area. Growing season is comparatively short, though. Therefore, year round enjoyment of fresh corn for example, involves rapid refrigerated transit from West Coast and Florida to Chicago and New York City markets. Preservation for off season consumption of these products has also become one of the larger storage activities. These four amount to about 20 percent of vegetable production.

United Fruit Co. is the best known example of this. It is hoped that in the future other tropical foods will reach our markets, as these foods and their storage conditions become better known.

Vegetable Production

Regarding fresh vegetables, California produces about 30 percent of these. New York, Florida and Texas account for another 20 percent. One-half from four states! Figures 6, 7 and 8[2], also disclose production points for other types of vegetables which are generally well removed from consumption (population) centers.

Meat Origins

Much of our beef cattle is raised in the West and Southwest, with Texas leading. But 30 percent of the slaughtering is done in the five cities of Chicago, Omaha, Kansas City, Saint Paul and Saint Louis.

Dairylands

Wisconsin and Minnesota account for about 20 percent of the milk and milk products. Pennsylvania, Minnesota and Iowa account for about 20 percent of the eggs.

These are some of the greatest concentrations of production of specific items. But the list could be continued to include almost everything we eat, as nothing is produced in the exact proportion to the area in which it is consumed.

All the above foods require very speedy handling or refrigeration to get them to or preserve them for the ultimate consumer before spoilage sets in. In most cases, both are used.

End Product From Grains Now Refrigerated

Grains are our only important food product that does not require refrigeration. And even with these, refrigeration is finding more and more use in bakeries as an aid to getting and maintaining a high quality finished product, as well as the original application of holding over peak production from work days for full week marketing.

Seasonal Factor

The second fact to consider in the need of refrigeration storage is that the bulk of fresh foods are produced during only a few months of the year. Some are harvested during the spring and summer. Others during the summer and fall. Yet U. S. consumers have grown to expect a complete supply of fresh vegetables, fresh fruits, fresh salads all year round.

Canning was the original method of handling the storage problem for

[2]See also Table 2 for key to graphs on Figs. 4, 6, 7 and 8.

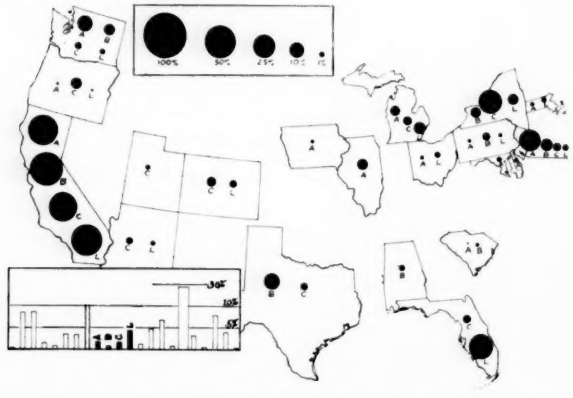


Fig. 7 — —Stalky vegetables like asparagus, brocoli, cauliflower and celery actually originate or grow in more than 20 states. However, one state again predominates, and although it is third in population, production of these items exceeds domestic use. To reach other United States users, refrigerated transportation and storage, plus considerable freezing of three items must be accomplished.

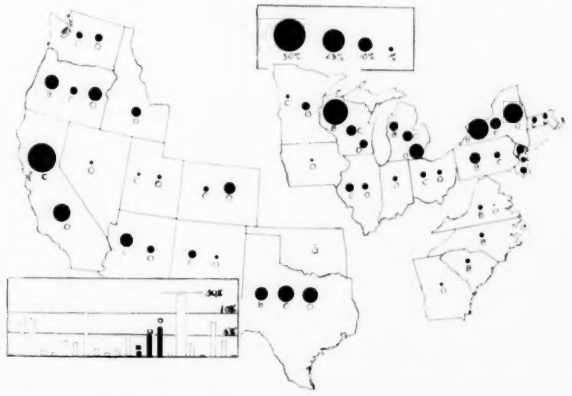
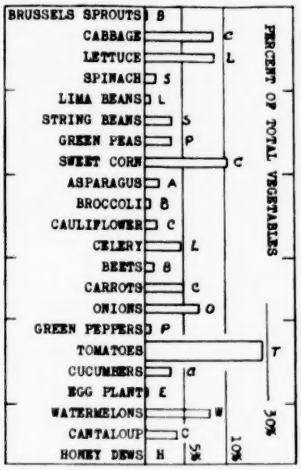


Fig. 8 — Barely 10 percent of the total vegetables raised in the United States are the root vegetables: beets, carrots, and onions. Yet heavy product origin is in five or six states, of which only half are relatively close to consumption centers. And probably the most popular (?) of all, the onion, involves special refrigerated storage conditions.

TABLES 1 AND 2 — COMPARATIVE PERCENTAGE PRODUCTION FIGURES FOR VARIOUS FRUITS AND VEGETABLES GROWN IN U.S.A.



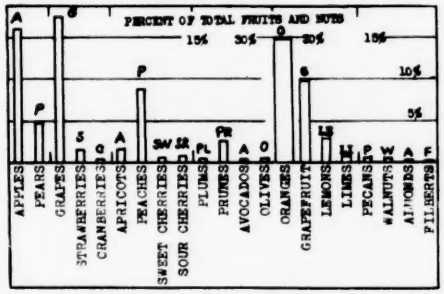


Table 1 above — Key to Charts Inset on Figs. 2, 3 and 5.

Table 2 left — Key to Figs. 4, 6, 7 and 8.

Note: Capital letter symbols at top or end of each column in these tables, corresponds to the letter symbol and solid column in the Figures to which the Tables refer.

most fruits and vegetables. Many canneries now use refrigeration to hold the produce until it can be processed. Even more have turned to food freezing in lieu or in addition to their canning enterprise. And food freezing is the cause of a constantly increasing short-time storage problem.

Imagine the collection, transportation, storage, and final distribution necessary to get this food from a field in California, or Texas, or Wisconsin to a table in Chicago, or New York, or Boston. Then picture the place of the food processor, the warehouseman, the carrier, the refrigerating engineer in this scheme of things. And be proud of your part in helping make this, our Country, the best fed nation in the world.

Credits: Data on food production given in this paper was averaged from data given in "Agricultural Statistics", 1954 edition, compiled by the U. S. Department of Agriculture, and published by the U. S. Government Printing Office

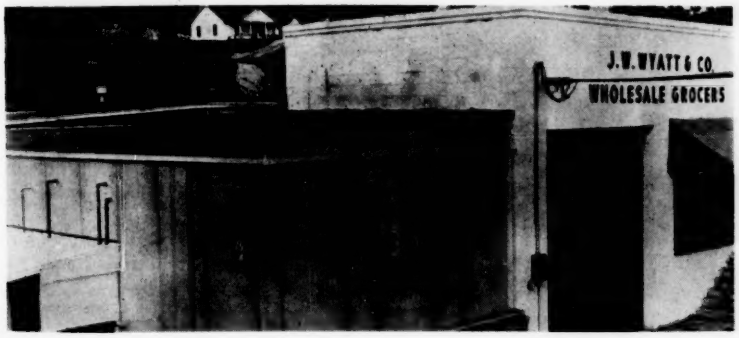
Wholesale Grocer Adds Outdoor Frozen Food Vault

ONE of the first wholesale grocers in the nation to install an outdoor frozen food vault with an integral tar and gravel roof was J. W. Wyatt & Co., distributors for Acme Food Stores in Danville, Va. The freezer, measuring 18 x 30 x 9 ft., was constructed and erected by Recony Sales and Engineering Corp., of Richmond, Va. Its exterior and interior wall sheathing is of Aluminum Metalply, with fiberglass insulation. With overlap construction of the wall sections, an exclusive feature, there are no hand holes in the walls for inserting lag screws, and no loose and separate cover plates for hand holes. This sectional construction also permits easy and economical expansion of the freezer.

Refrigeration in the Wyatt vault, which keeps the temperature at minus 5 degrees, is provided through two independent 3 hp air-cooled condensing units. A platform inside the Wyatt Company's main building was extended to permit same-level access to the freezer.

The unique feature, of course, is the integral tar and gravel roof, which eliminated the need for a shed roof or other makeshift roof protection. This feature, standard on most Recony jobs, insures a moisture- and vapor-tight ceiling.

In commenting on the installation, Garland M. Wyatt, president of the Danville firm, said that his company is highly satisfied with the results, and that storage capacity has been increased greatly, particularly in view of the fact that the freezer room is essentially an extension to his building, and does not take away from any of his present valuable building area.



Outdoor frozen food vault constructed for J. W. Wyatt & Co., Danville, Pa.

New Co-op Grocery Plant

CENTRAL Grocers Co-operative Inc., has under construction in Franklin Park (Chicago) Illinois, a $1,750,000 general offices and warehouse and cold storage facilities, it was announced by William A. Cassin, founder, in December. Massachusetts Life Insurance Company is reported to be the party financing the 400 member cooperative on a loan that will extend for 20 years. Central Grocers was founded in 1917 and services retail outlets in the area in Chicago and extending to points as far away as Waukegan, Rockford, Aurora and South Bend. The building contemplated involves 240,000 square feet and the site itself is approximately 13 acres.

Fans Keep Temperature In Stationary Cars

FRESH quality of highly perishable fruits and vegetables can be maintained at higher levels if fans in refrigerated or heated cars are kept in operation while cars are standing in railyards or sidings, according to marketing research report issued by USDA. Report says failure to keep fans operating in refrigerator cars after cars reach terminal markets is at present a weak link in shipment of fruits and vegetables. Auxiliary motors can be successfully used to operate these built-in car fans when loaded cars are left standing. In transit, fans are operated by car wheels.

Meeting Private Competition With Service Ideas — NARW Warehouse Operations Committee Serves Up Two

DISPLAYING its leadership among the associations, the National Association of Refrigerated Warehouses in December issued two bulletins to its members which related applied ideas for better warehouse operations. The first bulletin, dated December 4, was a 4-page set of instructions on repairs to concrete floors in refrigerated warehouses. (It was reported on in detail in the January issue.) The second bulletin, a 2-page circular dated December 11, described the mobile blast freezer operation used by one of the eastern operating firms.

The Warehouse Operations Committee of the Refrigerated Division, American Warehousemen's Association, has two sub-sections. The construction maintenance and refrigeration sub-section sponsored the two December *Idea* sheets. This sub-section is headed by Paul B. Christensen of Portland, Maine.

Mobile blast freezer used by Northeast Cold Storage Corp. Portland, Maine

Example of New Service

Mobile Blast Freezer was the title of the 2-page circular. The article was published as an example of just one kind of new service which refrigerated warehouses can perform to meet the changing needs of customers. The bulletin even suggested that such service would possibly prevent building of additional private space.

The mobile blast freezer described was built by the engineering department of the Quincy Market Cold Storage & Warehouse Company at Boston. It is a completely self-contained unit as pictured. A 50 hp diesel engine is the prime mover for operating equipment mounted on a standard flatbed semi-truck trailer. The diesel belt-drives two compressors and an auxiliary shaft from which pumps, fans and auxiliaries operate. Fuel for the diesel is No. 2 heating oil, and jacket water and condensing requirements can be supplied by the ordinary 3/4-in. garden variety water hose.

Freezing Capacity

Freezing capacity of the truck trailer unit is 12,000 lbs. per day. An added advantage is the fact that the trailer will accommodate approximately 30,000 lbs. of merchandise and can transport it to storage after completing freezer operations.

Freezing tunnel, 23 x 8 x 9 ft. high, circulates 10,000 cfm, operating with a coil temperature of minus 35 F. Liquid defrosting of the finned surface coil is continuous. Concentration for the defrosting liquid is mounted on the machinery section of the trailer together with evaporative condenser, compressors and apparatus necessary to complete the system. The plant refrigerant is ammonia, and a 4-cylinder V-type booster and a 3-cylinder VSA high stage compressor are used.

Northeast Cold Storage Corporation, subsidiary of the Quincy Market Cold Storage & Warehouse Company, Boston, Mass., owners of the unit, are making the mobile blast freezer available to their customers for on-the-spot freezing in 1958.

Thief Gets Away With Ice

POLICE of East St. Louis sought a thief with an unlikely taste in winter loot. He was wanted for breaking into City Products, Inc., and stealing more than two tons of ice.

Refrigeration Warehouse Opens in Hawaii

JUST completed is the Hawaiian Cold Storage Company's new refrigeration storage, said to be the first major public refrigerator warehouse to be built in the Islands in the past 39 years, it nearly doubles the volume of available refrigerator storage space.

From the builder's point of view, the building is interesting for several reasons.

It is the first Hawaii freezer plant built upon the precast, tilt-up slab technique.

It is the second largest warehouse in Hawaii to be erected in this manner.

The building contains the largest quantity of styrofoam insulating material ever installed here in one building.

The building will be used for food storage by the Hawaii Food Plan, of which Mr. Glueck is president.

All merchandise in the warehouse will be handled on standard conventional pallets.

Loadled Aboard Ship

Arrangements are being made for merchandise to be loaded onto these pallets aboard ship. When the freighter is unloaded, the pallets can be transferred to trucks and taken immediately to the warehouse, thus materially reducing the time the perishable cargo is exposed to high temperatures.

Mr. Glueck says refrigeration rates have been reduced and are now the same as those in effect on the West Coast.

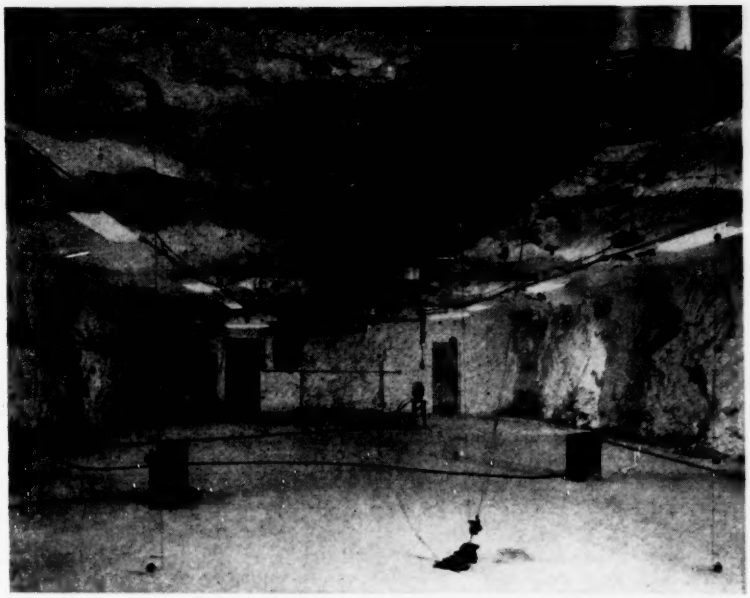
Including both the land and the building, the warehouse represents an investment of considerably over $300,000.

It has a 360,000 cubic foot space total, and a storage capacity of ten million pounds.

Beatrice Foods Record

RELEASE to the daily press in December, William G. Karnes, president of Beatrice Foods Company announced that the firm had reached a record high in sales for the quarter ending November 30, 1957. Earnings totaled one and a half million or 66 cents a share as compared with the previous 65 cents per share. In the nine months ending the same period the company showed a gain of approximately $9,400,000 or 3-6/10 percent over the same 1956 period. Profits showed an increase over the previous year.

Underground Heat Flow Data Developed By National Bureau of Standards



Underground chamber used by National Bureau of Standards in experiments on heat transfer from man-made caves to the surrounding earth. Heat was supplied through the ventilating system and from space heaters on the floor. To measure temperatures at various points, 385 thermocouples were suspended in the air, attached to the walls, ceiling and floor, and placed at intervals up to 12 feet in depth in the rock.

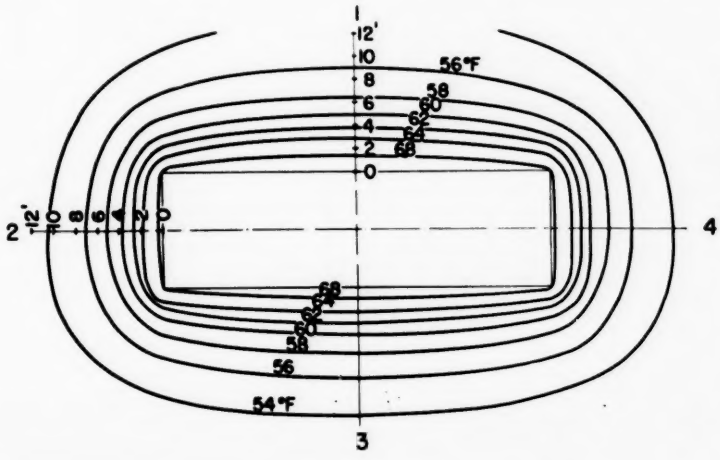
TECHNICAL Report No. 2122, U. S. Bureau of Standards, dated October 1957, provides mathematical data needed by designers for calculating heat transfer in underground chambers. A summary recently released, describes the theoretical analysis made by Bureau engineers and the practical experiments which followed. Actual research in underground caverns not only bore out the reasonable accuracy of the theory involved, but supplied the corrective factors as well.

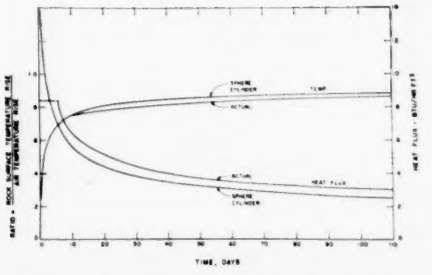
Much attention has been given to the use of natural or man-made caves by military, industrial, and civil defense groups for storage of goods or for shelter of personnel. Major problems encountered was that of maintaining the space at a design temperature which may differ from the surrounding rock. Heat transfer between the space and the earth must be considered.

Heretofore, adequate data on the heat flow have not been available. However, an analysis of heat transfer in underground chambers has recently been completed. *Results provide a quantitative basis for predicting mathematically how much heating or air conditioning a particular chamber will require to maintain a constant temperature.*

To establish design criteria, scientists at the National Bureau of Standards undertook both theoretical and experimental approaches. Shapes of underground chambers approach those of hollow rectangular parallelepipeds. However, a mathematical solution for transient heat flow outward from a rectangular parallelepiped would yield expressions in troublesome three dimensions. An infinite cylinder, or a sphere, may also be used to approximate the shape of a chamber, which solutions are much more readily evaluated. The radius of an equivalent cylinder or sphere can be easily computed from the surface area of the chamber for which it is an approximation.

NBS Studies were carried out for Chief of Engineers, USA, by B. A. Peavy, Heat Transfer Laboratory, NBS.





Above—Graphical comparison of actual heat transfer from space to rock, compared to results predicted from theoretical analysis. Left—Graph showing temperature distribution in rock up to 12 feet depth, around chamber whose temperature had been kept constant for 521 hours.

Conduct Actual Experiments

Some departure of results calculated for these simple shapes from those of an actual chamber must be expected as a result of end, edge, and corner effects. Accordingly, experimental results were obtained in actual caves to provide data for correction factors to make the mathematical solution applicable to actual chambers with adequate accuracy.

For the experimental work, a chamber, 100 x 35 x 10 ft. high was chosen. It was located a few hundred feet underground and remote from the surface in a horizontal direction. Thermal properties of the dense rock surrounding the chamber was determined at the Bureau. Heat input rate was measured with watthour meters connected to the heaters.

Initially the measured rock temperature was nearly uniform at 53.8 F. After a constant heat input of 8.4 Btu/hr/sq. ft. of rock surface had been applied to the chamber for 139 hours, the temperature of the air reached 75 F. At this time, a thermostat began regulating the heat input to maintain the temperature at 75 F, and heat input was measured continuously for about 110 days, until sufficient data were taken.

The results of this and two similar experiments showed that the heat input necessary to maintain a constant temperature was slightly greater than that indicated by the mathematical solutions for the cylinder or the sphere. Correction factors based on the dimensions of the chamber were therefore formulated. Numerical values of four mathematical functions needed for calculating the transient heat flow for the infinite cylinder and a wide range of values of the independent variable. The independent variable contains time and size of chamber, collectively.

New Canadian Freezer

THE Construction of a million dollar freezer plant by Interprovincial Freezers Ltd., in the heart of Chatham's industrial area, Chatham, Ont., Canada will be started soon. Announcement of the new major industry for the city was made jointly by the industrial promotion committee of Chatham Chamber of Commerce, and Willis S. McLeese, president of Inter-Provincial Freezers Limited.

According to the announcement from the company president, the new freezer plant and warehouse which will be readied in time for the 1958 processing season, will increase Canadian production of frozen foods by several million pounds.

Portable Air Conditioning Unit Helps Iceman

THE READY COOL Division of South House, Inc. of New Orleans has stepped up the promotion of its portable ice air conditioning unit. The equipment is a chilled water system which uses ice as the refrigerant. Water is sprayed over ice to get the temperature of the water down to 35 F. The unit recirculates the air when it is used inside a building.

These portable air conditioners are finding ready acceptance for many intermittent uses, such as: (1) Reducing the cooling down period for fracturing towers, cat crackers, etc. (2) The cooling of tanks and other large vessels so they can be cleaned and repaired more quickly and more comfortably. (3) The air conditioning of buildings for special occasions —auditoriums, gymnasiums, banquet halls, churches, etc. (4) To speed up the cooling of furnaces, kilns, and boilers, so they can be repaired in comfort and quickly put back into operation. (5) Repair and maintenance of holds of ships and barges under extreme weather conditions.

A catering concern in Houston, Texas, last summer successfully air conditioned a patio and outside lawn for a party of 300 guests with one of the units. A wall on one side held in the cool air. Shrubbery which stood eight feet high provided a second wall on the opposite side from the house. Canvas eight feet high served as the third wall, and the portable cooling unit completed the enclosure. The cooling was accomplished by "puddling the area" or filling it eight feet deep with cool air. The result—300 people enjoyed a pleasant meal, we are told, in 95-degrees heat without removing their coats.

These units are big users of ice. This, the iceman likes. On the other hand, the cost of the ice is a controlling factor in marketing the equipment. Its acceptance is pretty well restricted to poultry and industrial ice prices.—ICE NEWS.

Portland Penguins Cooled

A NEW zoo is being built in Portland, Ore. Recently when a flock of penguins arrived, Ken Davidson, Liberty Fuel & Ice Company donated several tons of ice to cool them off. The radio, newspapers and TV picked up the news item and gave the company some wonderful publicity. Ken says their "Zero" ice made the penguins feel at home.

TRRF Program For Annual Meeting

THE Refrigeration Research Foundation has announced the program for the annual meeting to be held March 6 to 8 at the Hotel Adolphus, Dallas, Texas. Council meetings will be held March 6 and 7 starting at 10:00 a.m. Discussions by top specialists of technical facts and research progress in the commodity fields served by the industry, as well as the outlook for the future will be discussed.

On March 8 a membership meeting will be held, starting at 10:00 a.m. In addition to the business session of the Foundation, the following top-notch investigators will discuss the following subjects:

Dr. Robert Smock, Cornell Univ., Controlled Atmosphere Storage for Fruit.

Dr. John M. Harvey, USDA, Fresno, Calif. Nursery Stock Storage.

Dr. Guy W. Adriance, Texas A&M College, Refrigerated Storage of Bermuda Onions.

Dr. Ralph Westcott, Holladay & Westcott, Los Angeles, Calif. Water Control in Refrigerated Warehouses.

Dr. G. Leonard Rygg, USDA, Pomona, Calif. Refrigerated Storage of Dates.

Dr. Wm. Stadelman, Purdue Univ., Immersion Freezing of Poultry.

Tax Revisions Advocated

THE NATIONAL Association of Refrigerated Warehouses has presented three statements containing its views on proposed changes in Federal tax laws to the House Ways And Means Committee which is conducting hearings on the modification of the Federal tax structure. NARW advocated the following adjustments which it believes will not reduce tax revenues for the Federal government but which will eliminate some present inequities:

1—A tax reduction for a portion of business income reinvested in the business to provide growth capital for small businesses and an extension of time for the payment of estate taxes through the purchase of tax anticipation certificates.

2—The elimination of preferential tax treatment of tax-free corporations who are in competition with proprietary corporations.

3—Support of proposals to repeal the Federal 3 percent tax on transportation of persons and goods that was adopted in 1942 as a wartime revenue measure.

Frozen Food Convention

THE 1958 Convention of the National Frozen Food Packers Association will be held March 2-6 in the Conrad Hilton Hotel in Chicago. Every important frozen food packer will be represented by top management, sales, production, and specialized personnel. This, in turn, will attract packer suppliers, packer customers, and others with a stake in frozen foods. Advance registrations to date indicate a good attendance of chain store and supermarket representatives, brokers, distributors, warehousemen, transportation men, and institutional buyers.

The General Program will be well rounded, with leading authorities tackling the principal industry problems of marketing efficiency, management efficiency, and production efficiency on three separate days. Numerous special meetings will deal with problems in transportation, frozen food handling, warehousing, public health, etc.

The principal suppliers of equipment and services to the frozen foods industry will hold exclusive domain in the large exhibit hall of the Conrad Hilton to show the latest in modern methods of producing, packaging, handling, and marketing frozen foods. Packers of prepared frozen foods will have their special niche—a block of fifth floor display rooms in the Conrad Hilton where they may show the newest in convenience foods to customers and press.

Sara Lee Bakers Show An Increase

HIGHEST volume in six years since the company was founded, was reported by Charles W. Lubin, president, Kitchens of Sara Lee. A December 1957 report from the firm executive indicates gross sales in excess of $13 million. The company increased its number of products during the year including refrigerated and frozen bakery lines. The sales record resulted from a large increase in a number of cities in which products are now available plus the gain in established market volume.

Food Investigation

A REPORT on food investigation made by the Food Investigation Board during 1956 has been issued by the Department of Scientific and Industrial Research of Great Britain. Among the subjects covered are: freezing and storage of fish, frozen meats, and storage of fruits and vegetables.

Freezing Process Converts Salt Water to Fresh

A FREEZING process for converting salt water to fresh, now under study at Carrier Corporation, was described by C. M. Ashley and C. M. Bosworth at the Saline Water Conversion Symposium in Washington, D. C., November 4 to 6.

The meeting heard reports on various salt-removing methods under development to help solve the fresh water supply problem, which is a source of growing concern in many parts of this country and the world. It is sponsored by the Office of Saline Water of the U. S. Interior Department and by the National Academy of Science National Research Council.

Mr. Ashley, chief staff engineer of Carrier's Research and Development Division, and Mr. Bosworth, senior research engineer, described the work on the freezing technique, which is being conducted under a contract from the Interior Department. The project covers both creation of a suitable process and evaluation of its economic feasibility.

Ice Vending Locations

THE OHIO Association of Ice Industries has issued a list of Ice vending locations in Ohio operated by active members of the Association. Copies have been sent to all Automobile Clubs in Ohio, as well as the Standard Oil Company and the Ohio Development and Publicity Commission, for inclusion in their touring guides as a service to the traveling public. This list it is believed will be of much interest to the traveling public in Ohio as well as those members of the ice industry who operate vending stations.

Ice Plant Burned New Owners Take Over

THE TUCUMCARI Ice Plant, Tucumcari, N. M. recently suffered a disastrous fire which resulted in total loss of the plant. What was left was taken over by Jack R., and R. E. Waterman and E. E. Higgenbotham who operate an ice plant at Los Animos, N. M. The plant has been rebuilt and modern ice service is being supplied to residents.

Safety Survey by NARW Shows Forty Award Winners

FORTY Safety Award winners are among the record number of public refrigerated warehouses responding to the annual safety survey now being conducted by the National Association of Refrigerated Warehouses, NARW President Sheffie Kadane announced. To be eligible for the Award, a member warehouse must have operated for a full year without a "lost-time" accident.

Receiving one-year awards are Arctic Ice & Cold Storage Co., Buffalo, N. Y.; Bakersfield Ice & Cold Storage Co. Bakersfield, Calif.; Binghamton Refrigerating Co., New York; Burbank Refrigerating Co., Calif.; Butte Warehouse & Cold Storage Co., Montana; City Ice Co., Gainesville, Ga.; Empire Cold Storage Co., Spokane, Wash.; Florida Quick Freeze & Cold Storage Co., Miami; Lancaster Ice Mfg. Co., Penna.; Mid-City Cold Storage Co., Chicago; Modern Freezing & Storage, Inc., Corvallis, Ore.; Newfane Storage Corp., New York; Tracy Ice & Development Co., Calif.; Birmingham Terminal Cold Storage Co., Ala.; Elkhart Cold Storage, Inc., Indiana; Greeley Ice & Storage Co., Colorado; Jones Cold Storage Corp., Norfolk, Va.; National Ice & Cold Storage Co., Marysville, Calif.; and Wisconsin Cold Storage Co., Milwaukee, Wisc.

Repeat Awards

Four cold storage plants have reported their fourth successive year without such an accident. They are Union Ice & Storage Co., Chico, Calif.; National Ice & Cold Storage Co., Stockton, Calif.; Beall Refrigerating Co., Santa Clara, Calif.; and Mowery Cold Storage, Bowmansdale, Pa. Haddon Ice & Coal Co., Haddonfield, N. J.; Merchants Cold Storage, Minneapolis, Minn.; National Ice & Cold Storage Co., Petaluma, Calif.; and National Ice & Cold Storage Co., Santa Rosa, Calif., have reported their third accident-free year.

On their second year are American Ice & Cold Storage Co., Everett, Wash.; Eastern Market Cold Storage, Detroit, Mich.; Lyndonville Ice & Cold Storage, New York, Madison County Cold Storage Co., Canastota, N. Y.; Seattle Ice & Cold Storage Co., Wash.; Sharon Coal & Ice Co., Penn., Turlock Refrigerating Co., Calif.; Union Ice & Storage Co.; Mountain View, Calif.; York Cold Storage Co., York, Nebr.; Haslett Warehouse Co., San Francisco, Calif.; Port Everglades Refrigerating Co., Fort Lauderdale, Fla.; Terminal Ice & Cold Storage Co., Salem, Ore., and Union Storage Company of Erie, Erie, Pa.

Practical Refrigeration Engineer

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Operating engineers of all refrigerating plants are invited to affiliate with the National Association of Practical Refrigerating Engineers, Inc., an educational association, "not-for-profit".

From the President's Desk

ACTING on advice from its senior Industrial Members and Honorary Members of NAPRE, the Association this year will attempt to publicize itself throughout the various industries employing large commercial and industrial refrigeration. One step undertaken last month in this column was to start acquainting INDUSTRIAL REFRIGERATION readers with the officers of NAPRE.

National Treasurer

Perennially re-elected to position of treasurer, NAPRE, is Leland Kenagy. Kenagy is Kansas City Manager for Railways Ice & Service Co., a subsidiary of Southeastern Public Service

Leland Kenagy

Co. He had formerly been chief engineer of the Kansas City plants and prior to that had been, consecutively, chief engineer, then manager of the Newton Ice Co., Newton, Kansas.

Graduated from Finlay Engineering College in 1930, Kenagy has since taken selected courses from the University of Kansas Extension School. He first joined NAPRE in 1933, attending his first convention that year at New Orleans. He was elected treasurer in 1946. Kenagy is a member of the Kansas City section, ASRE.

Secretary

Re-Elected National Secretary is J. Richard Kelahan, Technical Editor of INDUSTRIAL REFRIGERATION magazine. Kelahan was appointed Executive Secretary of NAPRE in 1952. Re-appointed annually until 1956 when he was elected National Secretary, Kelahan additionally supervises the National Office activities and is directly responsible to the President and Board of Directors for the Association's Headquarters.

Kelahan is a graduate of the U. S. Merchant Marine Cadet Corps, being in the first class graduated from this fourth of the five Federal academies. He sailed on U. S. Merchant vessels as a licensed officer and saw active duty with the U. S. Navy as Engineer Officer in WW II carrier forces. He worked as a junior engineer for a West Coast consultant, sales engineer and executive secretary, prior to his Chicago transfer. Kelahan is ASRE Section Chairman at Chicago.

Sergeant-at-Arms

Many outsiders to NAPRE often picture the job of Sergeant-At-Arms as one calling for brawn. About the only place that brawn would be required would be arranging an exhibit or one of the larger audio visual aids at a convention. NAPRE's Sergeant-at-Arms is responsible for physical details at all national meetings; that is, seating arrangements, speaker's paraphernalia, etc. Moreover, during the year he functions

George Paulick

Dick Kelahan

as an assistant secretary in looking after details that pertain to the national meeting program.

NAPRE's Sergeant-at-Arms is George M. Paulick, a member of California Chapter No. 2 at Los Angeles. Paulick was the national membership chairman, NAPRE, 1956 and 1957. He was active on various committees and as an instructor in the local chapter, becoming chapter president in 1951. At Los Angeles he served as an instructor in refrigeration and allied subjects in the L. A. Trade Technical Junior College. Since 1946, he is the assistant chief engineer of California Consumers Corp.

Chapter Reports

Many NAPRE members may have missed the announcement that Fred Herr of Los Angeles had won the reporting award for 1957. Fred's reports were most consistent, were universally informative. Readers of IR in general, and members of other chapters could always derive some educational benefit, either new or in review, from reports by Herr, the Judging Committee stated.

Frank L. Chase

W. F. STOECKER

Multi-stage Refrigeration Systems

WILBERT F. STOECKER is presently Assistant Professor, Mechanical Engineering, University of Illinois. His duties include teaching Heat Transfer, Fluid Mechanics, Thermodynamics, and Refrigeration. He is in charge of refrigeration research activities for his department.

This paper was prepared especially for the NAPRE 48th annual meeting by Stoecker at the suggestion of INDUSTRIAL REFRIGERATION's Technical Department.

Professor Stoecker, at the University since 1948, has worked during summers for Battelle Memorial Institute, Illinois Geological Survey, American Locomotive Company, National Warm Air Heating and Air Conditioning Association, Trane Company, and E. I. duPont de Nemours and Company. A member of the Research Committee, ASRE, he has presented technical papers before ASME, ASRE, and NAPRE. A contributor to INDUSTRIAL REFRIGERATION[1], he is author of a book, *Refrigeration and Air Conditioning* which is to be published this year.

an NAPRE Educational Paper

MANY refrigeration plants use multi-stage systems; one in which two or more compressors operate in series to pump refrigerant from an evaporator to a condenser. Multi-stage systems are more efficient. Why?

Two operations in the multi-stage system are especially different than in a single-stage system. These are (1) *removal of flash gas*, and (2) *intercooling*. Usually, these two operations occur in one vessel and the individual effects of the two processes cannot be distinguished. However, in this presentation these operations will be analyzed separately.

Predicting Power Demand And Compressor Capacity

The refrigerating engineer may at some time wish to predict how much flow one of the compressors in a multi-stage system must handle, or how much power it will require. This problem can be solved in practically all cases by two simple procedures; heat balances and flow balances (which also can be illustrated.)

Several different refrigerants are commonly used in multi-stage systems, but in the illustrations here ammonia is the refrigerant.

The name "multi-stage" implies that there can be two or more stages of compression. Usually there are no more than three stages. This paper will treat only two stages, but the principles developed could be applied to three stages if necessary.

The key to determining properties is found in the Mollier or pressure-enthalpy diagram[2]. A brief review of the diagram is presented first because it will be valuable in the later analyses. And, the pressure-enthalpy diagram is handy for other refrigeration work besides working with multistage systems.

Enthalpy

The pressure-enthalpy diagram is one in which the pressure of the ammonia is plotted on the vertical scale and the enthalpy is plotted on the horizontal scale.

What is enthalpy?

Rather than answer the question directly, examine several of the useful quantities which can be calculated when the enthalpies are known. For example, Fig. 1 shows an evaporator which has ammonia entering with an enthalpy of 150 Btu/lb. This enthalpy is designated by the symbol h_1. Ammonia leaves the evaporator with an enthalpy of 620 Btu/lb. The useful quantity which the enthalpies reveal here is the amount of heat transferred. The amount of heat transferred to each pound of ammonia is the difference in enthalpy which is

a) $620 - 150 = 470$ Btu/lb.

This value by itself does not disclose the refrigeration capacity since the number of pounds of ammonia flowing per minute must also be known. If there are 15 lb/min flowing through this evaporator, represented by the symbol w, the amount of heat transferred to the evaporator is

b) 15 lb/min x 470 Btu/lb = 7050 Btu/min

Since one ton of refrigeration is 200 Btu/min, the refrigerating capacity of this evaporator is

c) $$\frac{7050 \text{ Btu/min}}{200 \text{ Btu/min/ton}} = 35.2 \text{ tons}$$

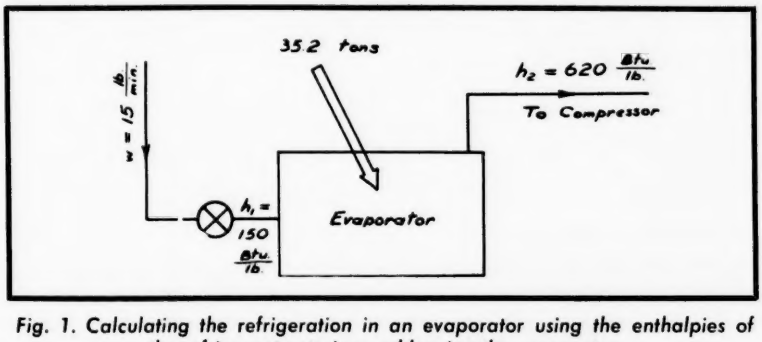


Fig. 1. Calculating the refrigeration in an evaporator using the enthalpies of the refrigerant entering and leaving the evaporator.

[1] Most popular recent *Industrial Refrigeration* papers: Liquid NH_3 Recirculation, Nov. 1955; NH_3 Liquid Return Systems, Dec. 1955.

[2] Chart No. 1, *Basic Refrigeration*, Guy R. King—the "official" NAPRE text; Chart No. 2, *Refrigeration Theory and Applications*, H. G. Venemann.

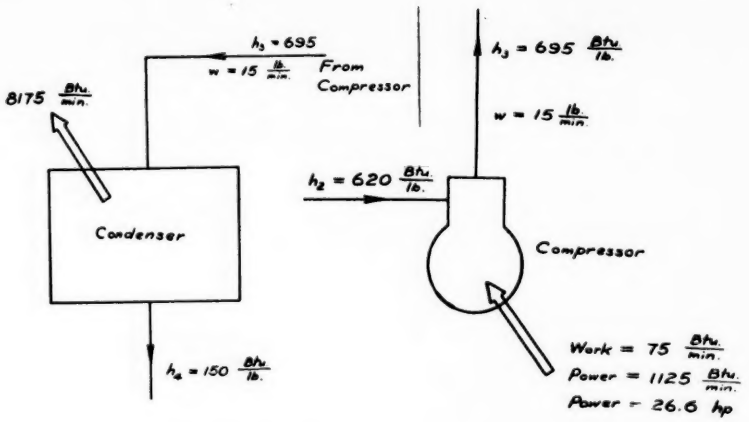


Fig. 2. (Left), Calculating the heat rejection at the condenser using differences of enthalpies. Fig. 3. (Right), The work of compressing a pound of NH_3 equals the change of enthalpy.

In a condenser the change of enthalpy of the ammonia indicates the amount of heat rejected from the condenser. In Fig. 2, for example, hot gas from the compressor enters the condenser with an enthalpy of 695 Btu/lb, and liquid leaves the condenser with an enthalpy of 150 Btu/lb. Each pound of ammonia therefore rejects

d) 695 − 150 = 545 Btu/lb.

With a rate of flow of 15 lb/min, the ammonia rejects

e) 545 Btu/lb × 15 lb/min = 8175 Btu/min.

The evaporator and condenser illustration in Figs. 1 and 2 show *one characteristic of enthalpies: the rate of heat transfer is equal to the change in enthalpy multiplied by the rate of flow.*

Compression Calculations

Another useful quantity which can be calculated when the enthalpies are known is the work of compression. In Fig. 3 the work of compressing a pound of ammonia equals the change in enthalpy, provided there is no heat gained or lost from the compressor and the compression is done without friction. This type of compression, of course, does not occur in an actual compressor because there is usually some heat transferred to the water in the cooling jacket, and there will also be friction.

The work which can be calculated from the difference in enthalpies will be the "ideal" work. The work of compressing one pound of ammonia in Fig. 3 will be

f) 695 − 620 = 75 Btu/lb.

Since the compressor handles 15 lb/min, the rate of doing work, which is called "power", is

g) 15 lb/min × 75 Btu/16 = 1125 Btu/min.

Each horsepower is equivalent to 42.4 Btu/min, so the power required expressed in horsepower is

h) $\dfrac{1125 \text{ Btu/min}}{42.4 \text{ Btu/min/hp}} = 26.6 \text{ hp}$

Having now seen the usefulness of enthalpies, the practical engineer moves next to the diagram which provides the values of these enthalpies. This is the pressure-enthalpy diagram.

Pressure-Enthalpy Diagram

One way to examine the pressure-enthalpy diagram is to build a skeleton diagram, step-by-step. First, as in Fig. 4, draw the vertical and horizontal lines which will become the pressure scale and the enthalpy scale, respectively. The pressure is in pounds per square inch absolute (psia), so if readings are taken from the pressure gage in the plant, atmospheric pressures should be added to them to convert them to absolute pressure. The ammonia exists at different phases on the diagram: liquid, vapor, or a mixture of liquid and vapor. These regions are shown in Fig. 4. The liquid line separates the liquid region from the mixture region and the vapor line separates the vapor region from the mixture region.

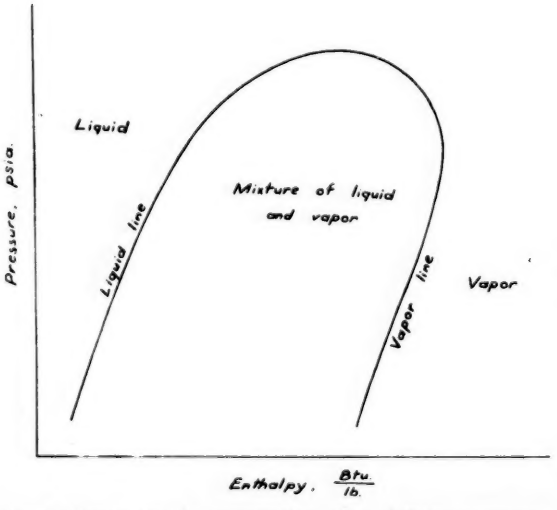


Fig. 4., Beginning the construction of a skeleton pressure-enthalpy diagram.

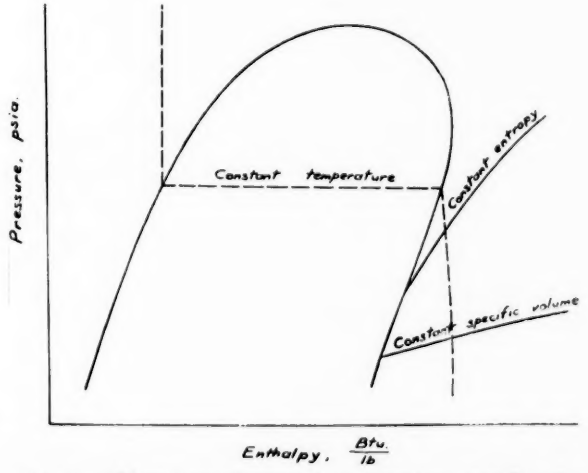


Fig. 5., Adding lines of constant temperature, specific volume, and entropy.

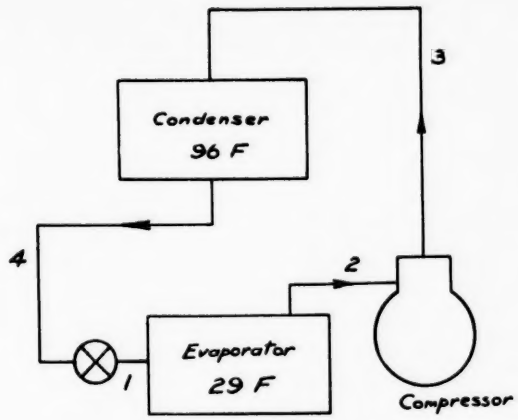


Fig. 6. (Above), The refrigeration system which combined the elements of Figs. 1, 2, and 3.

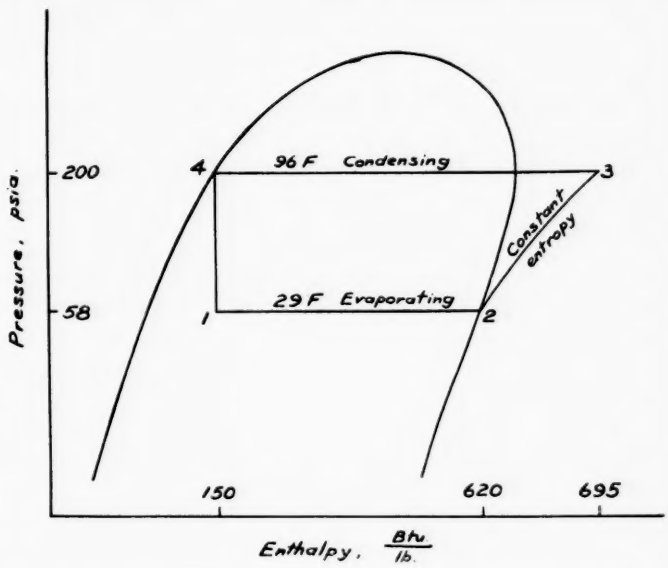


Fig. 7. (Right), Statepoints on the pressure-enthalpy diagram corresponding to the cycle in Fig. 6.

The next steps are to add lines of constant temperature, specific volume, and entropy to the chart as is done in Fig. 5. Lines of constant pressure and constant enthalpy are not shown in Fig. 5, but they are merely horizontal lines and vertical lines, respectively, on the chart. The line of constant temperature means that all points on the line are at the same temperature. The specific volume is the number of cubic feet which one pound of ammonia occupies. A high value of specific volume corresponds to a low density. The final line is the one of constant entropy.

What is entropy?

Rather than define entropy, just remember that the compression in Fig. 3 which occurs with no transfer of heat and is frictionless, follows the constant entropy line.

Refrigeration Cycle on Pressure-Enthalpy Diagram

What would the individual processes shown in Figs. 1, 2 and 3 look like if they were plotted on a pressure-enthalpy diagram? The combined elements with the addition of an expansion valve are shown in Fig. 6, and the cycle shown on the pressure-enthalpy diagram is Fig. 7.

The enthalpies listed in Figs. 1, 2, and 3 were not chosen arbitrarily, but correspond to the cycle in Fig. 7 which operates with a condensing temperature of 96 F and an evaporating temperature of 29 F. The evaporating temperature of 29 F fixes the evaporating pressure at 58 psia. Point 2 is assumed to be on the vapor line at which point the enthalpy is 620 Btu/lb. Following a constant-entropy line from point 2 to the condensing pressure, the enthalpy at point 3 is found to be 695 Btu/lb. The condensing pressure of 200 psia is dictated by the condensing temperature of 96 F. Point 4 leaving the condenser is assumed to be on the liquid line and the enthalpy at that point is 150 Btu/lb.

Process 4-1 which occurs in the expansion valve is a constant enthalpy process which is a vertical line on the pressure-enthalpy diagram.

What is the reason for the process occurring at constant enthalpy?

Thinking back to the characteristics of enthalpy, changes in enthalpy indicate the amount of heat transferred or the amount of work done. Suppose that neither work is done nor heat is transferred. There should be no change in enthalpy in such a case, and this is the situation in the expansion valve.

To be Continued in March

Army Air Conditions War College

ARMY officers learning to be atomic age generals will receive their pedagogy in facilities equally as advanced. A new $5 million completely air conditioned academic building with some 300,000 square feet of class room area is currently under construction at the Command and General Staff College site, Ft. Leavenworth, Kansas. Occupancy of the two and three story buildings is expected next summer.

Excessive heat and humidity, two of the most serious checks on peak performance, will be eliminated. Floyd S. Bryant, assistant secretary of defense for properties and installations, points out the reason for air conditioning. "Civilian schools and colleges operate on a very reduced basis, if at all, during hot weather, but those in the Department of Defense continue the year-round," he said. "Since training costs in the military departments can be relatively high, it is just good common sense to do everything we can to assure maximum efficiency from such programs."

Some 200 under-the-window units located in private offices and classrooms for instructors and students, can be individually controlled by room occupants. Larger areas will receive conditioned air from 40 fan-coil Weathermakers.

Chilled water for cooling the glass wall structure designed by Kivett & Myers, Kansas City architectural firm, and Angus McCallum, associate, will be supplied by two Carrier hermetic centrifugal machines. Total capacity of the units is 1,000 tons.

Measuring Heat Transfer In Refrigerated Trucks

THE Annual Refrigeration Roundtable of the 17th Annual Truck-Trailer Manufacturers Association Convention featured a panel-type discussion of the development of an industry standard method for measuring heat transfer. The meeting was Tuesday afternoon, January 21, at the Palm Beach Biltmore, Palm Beach, Florida.

The TTMA Refrigeration Roundtable, an annual institution for the past ten years, was an all-afternoon session devoted to an informal discussion of transportation of perishables.

NAPRE

Question Box

The National Educational Committee, NAPRE, answers monthly in this column, operating problems forwarded by members. The Committee appreciates answers from the field. Address questions and answers to Prof. Harold P. Hayes, Dean of Engineering, State Polytechnic College, San Luis Obispo, Calif.

More On Question No. 1214

NH_3 Boil At Minus 28 F?

QUESTION NO. 1214: What is the temperature of liquid ammonia at sea level when held in an open container? Why is it at minus 42 F?—Q. M., NYC.

ANSWER NO. 3: Congratulations to many sharp-thinking readers of INDUSTRIAL REFRIGERATION. Challenges to answer No. 1214 literally flooded our mail box. Haste to meet publication deadlines caused your Question Box Chairman and the Technical Editor to overlook the words "open container" in the question. Therefore the answer was in terms which were correct, but admittedly too vague.

A point frequently overlooked is the fact that ammonia tables give boiling temperatures at specific pressures which assume that the liquid ammonia *exists in its own vapor pressure.* If there is air mixed with the ammonia vapor in an open container, the vapor pressure is atmospheric less the pressure exerted by the air. In this case in question there was undoubtedly sufficient air to produce an ammonia vapor pressure considerably below 14.7 psia.

Answer No. 4 states the point very well. Answer No. 5 gives a chart which should prove useful. The Question Box is obliged for the interest. However, participation is invited immediately following question publication. Don't wait for a "first-class boner".—H. P. HAYES.

ANSWER NO. 4: Liquid ammonia at sea level in a covered flask will boil at minus 28 F provided the cover is vented to the atmosphere. A light stiff cardboard cover will suffice with a loose fitting thermometer through it.

If the flask is left uncovered, and a draft of air passes over the open flask, the temperature will drop below minus 28 F. As the extent of the draft is increased the temperature of the ammonia liquid will continue decreasing. The writer has seen this temperature drop to as low as minus 90 F when a fairly stiff draft passed over the container top.

The explanation for this is that ammonia liquid in equilibrium with its own vapor only, has a boiling point of minus 28 F at sea level pressure. When a flask is left uncovered, however, the total equilibrium pressure above the ammonia still remains at atmospheric pressure. There is, however, over the ammonia in this case a mixture of air and ammonia vapor. As the amount of air increases in this mixture the vapor pressure of ammonia decreases and the ammonia temperature responds to its own vapor pressure—hence the lower temperature.

An inexpensive means for securing low temperatures for experimental work is therefore always procurable by merely varying a mixture density of refrigerant vapor and air. If the air volume is sufficiently great there should be no reason why a temperature as low as minus 100 F is not procurable.—R.T.B., NYC.

ANSWER NO. 5: Just as the questioner is confused by one manifestation of partial pressures, so Answer No. 1 has given him only a partial answer. The fact is that you are both substantially correct. He is reading minus 42 F, but the pressure on his liquid is actually 14.7 lb. at sea level, and the saturated pressure of the liquid is reduced below atmospheric.

Ammonia placed in an open container at sea level shows a temperature, at the instant of pouring, minus 28 F. If allowed to stand, however, and if the container is uninsulated, rapidly a layer of frost builds up on the outside of the container. The resulting decrease in ebullition[1] . . . and convection currents resulting from cooling of the air at the surface of the ammonia vapor, and heating and expansion of the vapor itself . . . permits more and more air to mix with the ammonia vapor in the container until a point is reached where the surface of the liquid is exposed to a mixture of air and ammonia.

The boiling point then starts to fall. Eventually, when the densities of the air and ammonia reach the same .036 lbs/cu ft and the liquid has practically stopped boiling, the thermometer will show about minus 44.1 F. (Graph illustrates this relationship more completely). At this point, the ammonia pressure at the surface of the liquid is about 9.2 psia, the air pressure being 5.5 psia, the total pressure being 14.7 psia *in an open container.*

If Q.M. will now move his container to a spot where he can circulate water over the outside of his container, he will notice a great increase in ebullition and a rise in liquid temperature to minus 28 F. What has happened is this: the increased turbulence has driven the air up and away from the liquid's surface so that once again the total pressure has become the ammonia's pressure.—J.E.W., CHICAGO

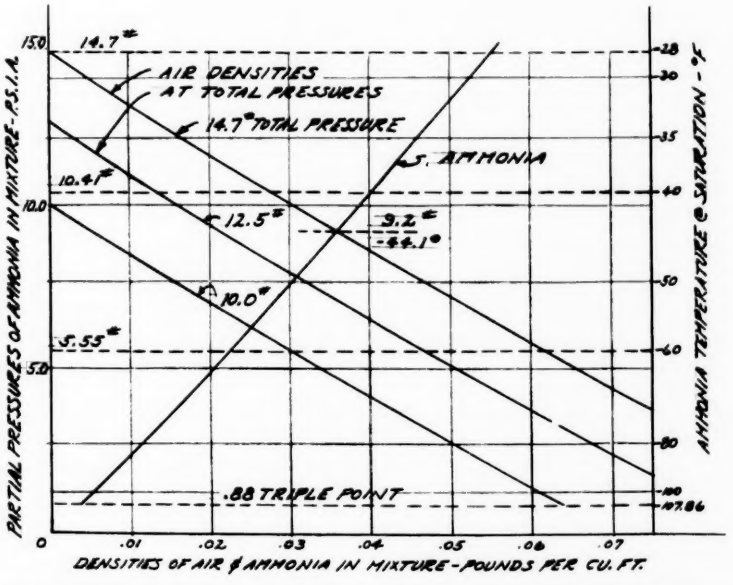
[1]Ebullition; effervescence; a boiling over; bubbling up; etc.

Corrects Gage Glass Surges But Wants "Why" of Remedy

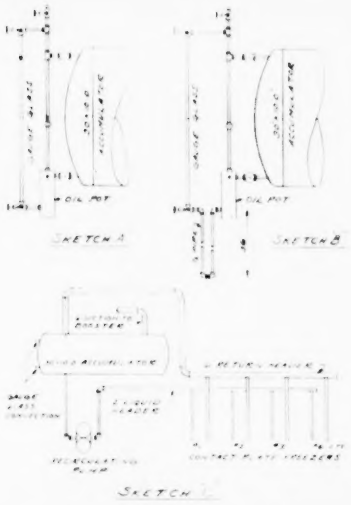
QUESTION No. 1215: Sketch "A" is of a well known oil pot type ammonia liquid level gage connected to an accumulator operating under 5 to 7 in., vac., suction pressure. The accumulator and pipe lines are covered with cork insulation; the oil pot and gage are not.

The accumulator is used with a battery of contact plate freezers and employing a recirculating pump. Piping connections are shown in Sketch "C".

Experience with this gage glass has been surging of oil and ammonia in the form of foam in the glass followed by loss of oil from the pot. Surging takes place at very erratic intervals varying from minutes to hours to days between surges. There has never been any unusual operation as far as refrigeration load and compressor operation is concerned. When we say unusual we mean other than normal operation for this particular plant.



Graph depicting relationship of NH_3 temperatures to the partial pressures of NH_3 in air mixtures.—Courtesy of the J. E. Watkins Co.



To be sure of no unequal pressure conditions in gage assembly, all pipe connections and valves to accumulator were examined for obstructions, ball check and pins were removed from gage glass valves and rubber gaskets of gage glass were examined to make sure they were not causing obstructions at ends of glass. All this had no effect in reducing surging.

In an effort to overcome this surging condition, several things were tried with no success. The one thing that did prove quite successful was as shown in sketch "B", the installation of a 36-in. loop of 1/2-in. pipe at the lower gage glass valve. This system has been operating quite successfully for several months with surging eliminated. During this time all operation conditions were the same as before.

a) What caused this surging in the first place?

b) How and why did the installation of the loop as shown in Sketch "B" overcome the surging?—S.M.R., So. Pa.

ANSWER NO. 1: The static head of the ammonia in the evaporator is not acting on top of the oil pot. It is by-passing the oil pot through the pipe column (the one containing the union, see sketch "A" & "B"). By fitting a valve in this pipe, and closing it, you will be using the NH_3 static head to raise the oil in the gauge glass to the level in the evaporator. Oil, being heavier than ammonia, will remain in the oil pot. When SMR added pipe to the oil pot, he added capacity.—D.N., Jersey City, N.J.

ANSWER NO. 2: We know, of course, that oil and ammonia do not mix chemically. There is, and can be a physical mixture of some proportion in the same way that coffee grounds would become a part of the coffee if the coffee is boiled violently. In the same way, if ammonia and oil are in the same vessel, and if the liquids are at rest and not in a state of ebullition, oil will settle on the bottom and ammonia will be on top, and the line of demarcation is very, very plain and distinct. However, once the ammonia starts to boil, then there is a violent action and the oil no longer remains in a state of rest in the bottom of the vessel and it becomes divided into small globules which, as would be illustrated in the coffee pot, permeates the mixture, but not in a chemical sense.

It is also true that some liquid ammonia is, in a physical manner, mixed with the oil in the oil pot. Bearing in mind that the oil has a specific gravity of about .9 and the liquid ammonia has a specific gravity of about .66, you can see that the liquid level in the oil gauge glass is not going to give the exact liquid ammonia level in the vessel, but the liquid indicator is merely a relative matter.

In sketch "A", the seal between the liquid and oil in the glass is not too great. Therefore, we would expect foaming to take place in the glass only when the suction pressure or evaporating pressure is lowered. Then, when the ammonia that is entrained in the oil is going to start to evaporate, that causes the foaming. Foaming can be caused by no other reason, and that type of oil pot, installed as is shown in section "A" can work perfectly when there is no great fluctuation in evaporating pressures.

However, sketch No. "B" shows the right cure for it, as the questioner's experience indicates. Here we have an additional 36-in drain leg, which means that the chance for liquid ammonia getting into the oil in the gauge glass is remote. In the first place, any tendency for ammonia to travel through the U-tube would be defeated by the fact that the N-tube is not insulated and therefore is absorbing heat. That is just enough to drive any entrained ammonia back up through the oil pot and into the accumulator. The U-tube gives a better seal and that is the only thing that is accomplished, and therefore there is little or no ammonia entrained in the oil in the gauge glass. Consequently, there can be no foaming when the suction pressure or evaporating pressure is suddenly lowered. —C.G.Q., Chicago.

Editor's Note: Like Questions No. 1214 and 1215, Questions No. 1221 and 1223 received many answers. All are helpful, but duplicate one another to a great extent. Therefore in these instances, only the first few replies are published. The Question Box is grateful to all who made the effort.—J.R.K.

High pH Detrimental To Skating Rink Grid?

QUESTION NO. 1221: I am seeking information on a calcium brine situation I am concerned with. About two years ago in the plant I operate, a leak in the evaporator occurred during an ice show. I had to continue to operate although ammonia was leaking into the brine system (12,000 gal.). After the show I boiled the brine and removed most of the ammonia, then added acid to reduce to proper pH (advised 8.5).

Since that time I have repaired two more tubes that started to fail. Although I got at them quicker, the pH climbed to 9.4. I boiled the brine and got the pH down to 9.

Now comes my problem. Should I add acid again to remove the ammonia that remains in the brine; dump it and start new (expensive); or am I in any danger of injuring piping in the ice rink floor, which is buried in concrete.

Our system is all iron construction with a shell and tube condenser, and evaporator; rink size 200 ft. by 85 ft.—E. McC, Butte, Montana.

ANSWER NO. 1: In view of the facts stated, it is recommended that the present brine be dumped. Make up a new salt brine, being sure that all the ammonia leaks are repaired. Add 30 gallons of Hacco No. 8 Stabilizer which consists partially of chromic acid. It will hold and correct any corrosive tendencies.

In case of future ammonia leaks, neutralize to a pH of 7.0 to 7.5 with muriatic acid. This acid will convert the ammonia to ammonia muriate as long as his temperatures are down to 20 F or below. At these temperatures the ammonia muriate is stable but if temperatures increase the ammonia muriate is unstable and converts back to free ammonia. After a period of time the ammonia will disappear. This procedure has been used over a long period of years with many tanks and are all in satisfactory condition at present.—H.W.H., Los Angeles.

ANSWER NO. 2: More acid will not injure the piping, *provided* the treatment is applied slowly and mixed well to avoid dropping the pH value into the acid range. However, sodium dichromate is suggested instead of a strong acid. This will not only drop the pH value, but it will provide a chromate concentration tending to inhibit corrosion.

A sodium dichromate dosage of 15 lb. in 12,000 gallons will result in a chromate concentration normally adequate for corrosion protection, and will probably reduce the pH value from 9 to about 8. If a somewhat higher dosage is needed to establish the desired pH value, the additional chromate will not be objectionable. It will simply provide a greater margin of reserve to offset the gradual loss occurring during operation. Unless there are some galvanized surfaces in the system that you want to protect, there is no particular need to reduce the pH value below 8.5.

Chromate protection is not likely to be as stable in a dirty brine. Perhaps you ought to consider dumping the brine and thoroughly flushing the system. It would take about 12 tons of salt. New brine should of course be treated from the beginning with sodium dichromate. The system should also be checked to eliminate conditions such as splashing which may be introducing an excessive amount of air in the brine.—K.M.H., St. Louis, Mo.

ANSWER NO. 3: Although alkaline brines are harmful to most non-ferrous metals, systems consisting of iron only may operate with a pH as high as 10 of 10.5. (Ice and Refrigeration, September 1948, page 46.)

Systems containing both iron and zinc, or other non-ferrous metals, should be

held to a pH of 8.0, although ice plants with galvanized cans frequently operate with a pH of 8.5 but only after a slow build-up and under close observation.

It is recommended that the brine in the all-ferrous skating rink remain untreated as it is not always possible to add just enough acid to neutralize the brine and not damage the equipment. (ICE & REFRIGERATION, March 1941—"A Treatise on Chemistry of Brine")—O.P.B., BIRMINGHAM.

Substitution of NH_3 Parts In Refrigerant 12 System

QUESTION NO. 1222: Our plant was converted to Refrigerant-12 several years ago. A York 5 hp 3x3 ammonia condensing unit that was taken out of service then, has not been used since that time. Can the entire system or any of the component parts such as the compressor, condenser, receiver, or evaporator (unit coler) be converted and used with Refrigerant-12?—C. G., S. E. Penn.

ANSWER: In general, I am not a strong believer in converting units from one refrigerant to another. My objection is that, because of differences in refrigerant characteristics, a well balanced system is not always obtained. In the case of the conversion you are considering, I offer the following comments:

Compressor—You may experience shaft seal difficulties if the seal is a packed one. The Refrigerant-12 may affect the packing.

Condenser and Receiver—The capacity would be changed, but there would probably be no other difficulties.

Evaporator—If the evaporator is a flooded one, you will experience oil return difficulties.

Suction Line—This would have to be made larger. The liquid line would probably be adequate.

Controls—You would have to install controls designed for Refrigerant-12 operation.—N.S., SAN LUIS OBISPO.

Keeping Inhibitor Active In Mixed Brine Solution

QUESTION NO. 1223: Mine is an Arctic Pownall stationary can raw water system. There are two units of 20 and 30 tons capacity, installed in 1922 and 1923, respectively. The brine tank plates together with the cans have not been changed or removed from their position since then.

In September 1956 I made new brine for the larger unit, using local $CaCl_2$ The quantity was about 18 tons, and it was a dirty brown in color. About three months later a large leak developed in the rivets of the brine tank. This was repaired and the brine loss was made up by adding ½ ton NaCl, as $CaCl_2$ was not available. Another leakage again developed this August and it too was repaired. As before another ½ ton NaCl was added. So now I have a mixture of $CaCl_2$ and NaCl brine.

Incidently I find that by addition of NaCl there seems to be better performance. But the density of the brine does not stay for long and falls rapidly, although in a fixed can system there is no loss of brine, as the cans are fixed in position and only the blocks come out. But that is one thing I want to know, why?

Apart from this, the pH value was taken and found to be 5.6. This was in August. So I added 25 lbs. of caustic soda, and the pH was 6.67. Now as per data book I added 15 lbs. sodium dichromate per 1000 cu. ft. brine plus 26% caustic soda. The brine is about 1600 cu. ft. The dichromate added by me was 30 lbs. plus 26% caustic soda, slightly more than specified as I allowed for the NaCl content of the brine. On analysis about five weeks later the pH was 6.86 and the chromate content NIL. The chemist said that there was a lot of iron rust in the solution and it was possible that this caused the chromate to precipitate out of solution.

The problem is how to keep the dichromate in solution? Why should it settle down? Can you kindly explain this phenomena and show me what to do to rectify the position. The proprietors wish to know if it is good practice to add sodium dichromate plus 26% caustic soda as a method of brine corrosion control. How is it that some authorities give 15 lbs. and other 50 lbs. of dichromate required? Why so vast a difference? Which is a better figure for better performance and control? In my case of mixed brine what do you recommend? S.N.S., Bombay.

ANSWER NO. 1: To correct the troubles related it is suggested that S.N.S. do away with calcium chloride brine and substitute a sodium chloride (NaCl) brine, as it appears the latter is available and the CaCl is not always obtainable. Therefore substitute sodium chloride and use chromic acid to keep the chromate content at 65 ppm. The pH should be above 7.0 and caustic soda is satisfactory for use to adjust the pH factor.

S.N.S. states that the pH is consistently low. This is possibly due to intake of air. This could be pulled in through the agitator or a condition where the brine falls through or is exposed to air. The agitator should be checked for leaks, and if so, corrected.—H.N.H., LOS ANGELES.

ANSWER NO. 2: It is unfortunate that you have had to mix sodium chloride with calcium chloride in your brine. In such a mixture, the gravity test is no longer a good measure of brine strength and freezing point.

The most desirable thing to do would be to (1) drain the system and thoroughly flush out dirt and rust, (2) repair leaks and make a good tight system, then (3) make up new sodium chloride brine treated with sodium dichromate. I am assuming that the system is not operated at temperatures below 0 F. For subzero operation, calcium chloride would be required.

If you are not in a position to make up new brine, I would repeat the dichromate treatment from time to time. The chromate will tend to be absorbed by the dirt and rust sediment, and the loss should be replenished as needed.

Whether to apply 15 lb or 50 lb treatment to your tank is a matter of judgment. Experience has shown that a chromate content of 100 ppm provides a considerable margin above the minimum required for substantial corrosion protection, but some operators prefer to apply much more than this reasonable dosage. For a system containing 1600 cubic feet, 15 lb of sodium dichromate will result in a concentration of approximately 100 ppm.

A higher dosage simply provides a greater margin of reserve to offset the gradual loss that normally occurs during operation. There is, however, a possible disadvantage in carrying a very high chromate concentration. If operators who come in contact with the brine are careless and do not frequently wash the skin or clothing that becomes saturated with brine, then the higher chromate concentration increases the hazard of skin irritations called "chrome itch".—K.M.H., ST. LOUIS.

ANSWER NO. 3: In September 1956 a new brine was made using calcium chloride. It is possible this brine was mixed directly in the tank without regard for heat generated when calcium chloride is dissolved in water to the extent that excess heat caused damage to the old equipment.

Standard U.S. data books recommend the use of 100-126 pounds of sodium dichromate per 1000 cubic feet of calcium brine plus 27%-30% by weight of 98% pure caustic soda so that the proper amounts for the 18 tons of calcium chloride used in this instance should 200 pounds sodium dichromate plus 60 pounds caustic. (The percentage of sodium chloride in the brine at the present time is low enough to confine our remarks to a calcium brine.)

Since the original calcium chloride used was a dirty brown in color, and since a specific gravity was not given, it is possible the calcium chloride was of an inferior quality resulting in a weak brine which in turn may become acid more rapidly because of its greater ability to dissolve air. In other words, air is more soluble in a weak brine than in a strong brine.

The pH of an old tank should never go below 7.0 and if rusting is severe a pH of 8.0 is normally recommended. —O.P.B., BIRMINGHAM.

Radiant Comfort Cooling Without Ceiling Condensation

QUESTION NO. 1224: Radiant cooling ceiling panels are being used successfully in air conditioning jobs in San Francisco. What is the theory behind these panels? How do they prevent objectionable condensation?—J. S., Chicago.

ANSWER: Heat can be transferred by conduction, convection, and radiation. These methods also apply to cooling a human for comfort. For example, you can cool your hand by placing it on a cold surface (conduction), by placing it near a cold surface (radiation), or by placing it in a cold air stream (convection).

The theory of radiant cooling by ceiling panels is that the human body plus walls of the room and other objects transfer heat to the ceiling by radiation. The heat gain of the room and the heat dissipated by individuals in the room are therefore carried off by the medium which cools the ceiling panels. This medium is usually piping carrying a cold liquid. This method of cooling is in contrast to the technique of carrying away all of the heat gain by means of circulating cool air.

To prevent condensation on the cold ceiling it is best to blanket the ceiling with a supply of very dry ventilating air. Thus, the system is really a combination of the conventional air cooling method and radiant cooling.—H P. HAYES.

Sputnik Enters Refrigeration Field

QUESTION NO. 1225: Maybe I don't understand the fundamentals of heat transfer. I always thought that the faster cool air blows past an object, the greater the cooling effect. Why, then, do the scientists say that satillites will burn up on re-entering the atmosphere. It must be at least minus 60 F as such high altitude. That should be cold enough to cool anything.—Thomas

ANSWER: For the usual range of velocities in normal engineering situations, heat transfer is improved by an increase in air velocity. However, in the supersonic range, shock waves become a factor to reckon with. Because of the unusual effects that shock waves have, the usual rel tionships of skin friction and heat transfer no longer hold true.

For convenience in dealing with problems, don't worry too much about the heating effect of skin friction until you get near-sonic speeds. Remember, however, that at any speed, skin friction means that pressure drop occurs and has to be overcome by increased power input.—H. P. HAYES.

Combustion Efficiency

QUESTION NO. 1226: Part of my responsibilities include boiler operation as well as refrigeration. Will you answer two questions for me?

1. What does boiler horsepower mean?

2. How can an Orsat analysis tell me whether or not my combustion is efficient?—Wm. C., Chicago.

ANSWERS:

1—Boiler Hp

The engineering term *boiler horsepower* is one that is going out of common use. In figuring the horsepower of a boiler, count one boiler horsepower for each 34½ pounds per hour of water that can be evaporated from and at 212 F. This is the same as saying that one boiler horsepower is equal to 33,479 Btu hr delivered to the water in the boiler. Actually it is an arbitrary method of rating, so be careful that you do not confuse it with the horsepower load that the boiler can carry in the form of power machinery (turbines, etc.).

2—Orsat Analysis

In its usual form, an Orsat analysis results in measuring the percentage of certain gases in the total exhaust gas. It measures in percentage by volume

Carbon dioxide
Carbon Monoxide
Oxygen
Nitrogen (by subtraction)

Fuel oil and natural or manufactured gas consist primarily of carbon and hydrogen. When burned by air, the carbon combines with oxygen to form carbon dioxide, and the hydrogen combines with oxygen to form water vapor. The nitrogen which exists in the air simply passes through the combustion without combining with anything. It shows up as nitrogen in the exhaust gases.

If you are using too little air, the exhaust analysis will reveal substantial amounts of carbon monoxide. This means that you have not completely burned all of the fuel and utilized its heating value to the fullest.

If you are using too much air, the exhaust will show substantial amounts of oxygen. By proper calculations you can determine exactly what the exhaust gas composition should be for best efficiency.—H. P. HAYES.

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New Question

Humidity Rains Off Provision Room Ceiling

QUESTION NO. 1227: Ceiling of our our meat (provisions) holding cooler is finished with a type of mineral cement (white) to 3/16 in. maximum thickness. This new addition was operated for three months then shut down one week for track leveling adjustments, during which period we left a 10 x 10 ft. 8 in. inter-connecting door open to sales cooler. Sales cooler was in continuous use.

When hold cooler was secured, condensation occurred on ceiling finish and metallic objects in room. It was not re-evaporated when room was placed back in operation. It has been a nuisance situation since, with water dripping over product and personnel. How do we remove the water with our existing evaporative surface?

Surface in this room 30 x 50 x 14 ft. consists of six ceiling hung units. The three arranged parallel and approximately 5 ft. from unit center-line to wall in which the large door is located, are rated 13,000 Btu/hr/10 F. TD. Three 7500 Btu/hr/10 F TD units are similarly located from the opposite 50 ft. wall. The 13,000 Btu units circulate 2200 cfm. The 7500 Btu evaporators circulate 1200 cfm and all units circulate air continuously.

Air inlet is through opposite sides of unit and discharge is through circular opening in top and against circular metal diffusion plates which are approximately 9 in. away from ceiling. Coil air inlets face one another, that is, in a row of 13000 Btu units, inlets for 1st and 2nd units, and 2nd and 3rd, face one another.

Temperature of the room has been maintained by the units at 34 F, DB. Product turn-over is 48 hours. We have experienced no appreciable shrinkage so we believe humidity is adequate, but our insulation contractor and finish supplier believe that the humidity is excessive for the evaporative surface to do the added work of drying off the finish, track, rails and electric conduit.

In their opinion the units do a "sensible" job and the added moisture due to climatic conditions during the week's shut down is too much for the units at the 10 F TD. However, we have same type of equipment in the sales cooler and do not experience this condition even though it is open to shipping dock almost constantly during business hours. –FLK, Chicago.

Heat Calculations

QUESTION NO. 1228: How is the heat load figured for an open top refrigerated food display case; with gravity air circulation and, with forced convection?–Calif. No. 3, Sacramento.

Engineering Economics

QUESTION NO. 1229: Will you do a sample problem to show how the "cost of money" enters into comparing which of two systems to use? How can I determine whether to use a system of high initial cost and low operating cost, or vice versa?–E.R., Chicago.

Do Home "Freezer" Cabinets Freeze Food Efficiently?

QUESTION NO. 1230: We are having an argument among our chapter members about home freezers. One group says that home freezers have adequate freezing capacity. The other side says cabinets and units are intended only to hold foods which are already frozen. Which side is correct? T.A.K., St. Louis, Mo.

Checking Refrigeration Charge

QUESTION NO. 1231: Is there any sure way of determining whether or not a system has the correct amount of refrigerant charged into it? What happens if a system is overcharged or undercharged?–R.V., Green Bay.

Camp Refrigeration

QUESTION NO. 1232: I do a lot of camping and would like to build a portable refrigerator. Getting ice is so inconvenient that I would like to use bottled CO_2 or some other bottled gas. How can I figure my refrigeration capacity? S.J.A., Chicago.

Seeks Regulation Source on Compressor Relief Valves

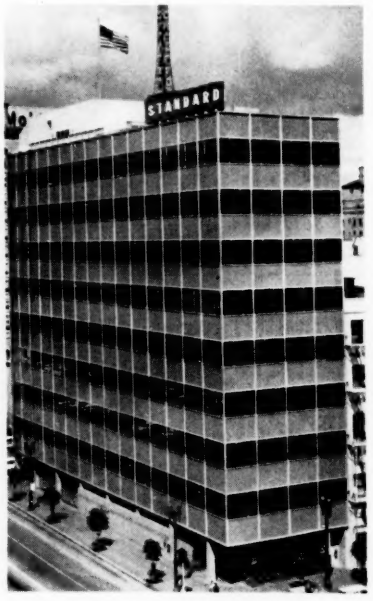
QUESTION NO. 1233: Where may literature be located on sizing safety or relief valves for booster compressors or first stage compressors of multi-staged refrigeration systems. What should the pressure setting be? Where should the relief valve discharge and what precautions should be taken in the location of the discharge? Is there any code or standard in the industry which would cover this situation? R.H., R.K., and R.R., Chicago.

News Notes and Chapter Activities

Sun Effect On Building Operating Costs

LOS ANGELES–Solar Radiation's effect on window glass and its prevailing use of large expanses in modern buildings, can add 50 percent to air conditioning operating costs. So said the Los Angeles NAPRE speaker on November 20. He was Patrick Kelly, building superintendent, Standard Federal Savings Co. building in downtown Los Angeles, in which the plentiful use of window glass is one of the architectural features.

In his preliminary remarks, Kelly sought to give his audience some concept of the solar "radiator" from which the earth receives so many benefits. He presented some startling figures about the sun! Average energy received by the earth is about 450 billion hp. However, because of the small size of the earth and its distance from the sun (93 million miles) the earth can intercept only about one two-billionths of the solar output.



Extensive use of special window glass in this Los Angeles downtown office building reduces solar radiation from the sun, resulting in air conditioning economies. The building uses one-third less refrigeration for air conditioning than would be required with conventional windows.

Getting fanciful, Kelly said that if earth were to be charged for a year's service from a ficticious Solar Power & Light Co. inhabitants would have to pay a staggering bill.

"Let's say," Kelly declared, "that we pay a price of 1-3/4 cents per kw hr.; the annual budget for the United States alone would be 327 quadrillion dollars. Greater New York would have to pay approximately 100 million dollars for one day's service of sunshine! It would take 100 million tons of soft coal to reproduce the energy reaching the earth from the sun in one minute".

Energy Conversion Explained

Most of us, Kelly pointed out, talk of the heat of the sun. We find, he remarked, air conditioning engineers designing systems to take care of the heat transmitted by the sun, in addition to their internal load. But the problem, the speaker said, is not concerned with heat radiated from the sun, but with energy . . . . not heat in the sense of radiated heat.

"Energy from the sun," he explained, "is radiated in the form of waves, waves that have a length of from 1.5 to 3/100,000-in. in length. The sun is analogous to a radio sending station and is constantly radiating these energy waves at a wave length which is about the same length as our radio waves.

"These are, in effect, electro magnetic

waves—waves of energy—which pass through the window glass of a building and are converted into sensible heat. The electro-magnetic waves are of a short wave length which has the ability to pass through the glass. Upon being converted from energy to sensible heat, the wave length changes to a long wave which cannot re-pass the glass, therefore trapping the heat."

Kelly explained that the waves reaching the earth strike the glass of buildings in three ways—by direct waves, by sky diffuse, or by ground diffuse. In the first method, he said, the waves strike the building directly. In the second method (sky diffusion) they are diverted to an indirect angle to strike the surface of the building by dirt, particles of dust, or pollutants in the atmosphere, making it possible to receive solar radiation on all parts of a building.

The third method (ground diffusion) according to Mr. Kelly, is again caused by bounce, in which waves hitting earth-bound surfaces are directed to the building from the angle at which they make contact.

Solar Load Considerations

For the reasons cited Kelly declared, it is necessary to take direct, ground and sky diffused waves into consideration when planning a system for overcoming solar radiation in the design of an air conditioning system. Since the most effective are the direct waves, and these waves are more critical in winter, it is more difficult to keep a building with a large expanse of glass cooler in winter than summer, according to Kelly.

Position of the sun on the azimuth and the angle of incidence play an important part in the effect of solar radiation on a building. These, he explained, can be calculated or determined for an hour, any given day in the year, any place; and computations of solar energy transmission can be made. With a chart, the speaker illustrated that on June 21 the sun is at the highest angle of incidence, approximately 86 degrees; while on December 21 it is at the lowest point, or approximately 32 degrees.

"It is readily seen," he said, "that at an angle of 86 degrees the sun is almost directly overhead. Therefore very few direct waves hit the surface of the building, and, of course, elevation of exposure of the building surface must be taken into consideration. If the angle dropped from 86 to 32 degrees, energy waves from the sun are almost directly on the surface of the building, considering the exposure".

Practical Experiment Cited

The speaker said that a 300-watt light bulb placed behind a sheet of window glass will make the glass too hot to handle, whereas a 900-watt electric iron placed in the same position will not heat the glass. The explanation is, he said, that the light globe radiates energy in the form of short waves, whereas the iron radiates the long waves of sensible heat.

"This problem," Kelly said "has been giving designers of new buildings which have large expanses of window glass some headaches". In his own building—Standard Federal Savings Building—he experienced the following conditions: In the summer months, with outside temperature as high as 110 F, he had no trouble keeping the temperature of the offices in the building at 74 F with a thermostat setting of 74 F. However, in winter months temperatures in the offices have actually been 90 F with a thermostat setting of 74 F, while outside temperature was only 58 F! This, in spite of the fact that two 100-ton compressors were running full capacity to chill water for air conditioning.

Applications Tried And Special Glass Adopted

The speaker cited various methods that were tried to alleviate the solar gain condition: Heat absorbant glass, with results not very good; inside horizontal metal venetian blinds; wooden venetian blinds; jalousies, etc. Most of them keep the light out, period. Projectors over the windows for shading, and double glass windows with half inch space between were also tried with negligible results. Amount of radiation cut down by those methods was too small to be of significance, he said. Reflective-tvpe screens on the exterior of the building, he declared, were effective in cutting down solar radiation, but the maintenance cost of such steel shades was quite high.

Use of Clarex glass in the windows (in exposure areas far exceeding the conventional office building) has given good results, according to Mr. Kelly. With that special glass in place, he said, it has been possible to use one third less refrigeration tonnage for air conditioning than had been needed in the building.—Fred Herr.

Pow-Wow of the Chiefs

OLYMPIA—Chief Engineers, NAPRE members from three Pacific Northwest breweries, met at a recent gathering and immediately went into private pow-wow in the seculsion of the noisiest section of any plant — and the place each feels most at home—the engine room. From l. to r., Archie Waterbury, Heidelberg Brewing Company, Tacoma; Mort Bell, Sicks' Rainier Brewery, Seattle; Falconer Anderson, Olympia Brewing Company. The meeting was held at Olympia, Nov. 8.

Western Pennsylvania Elects Joins Local ASRE Program

PITTSBURGH — Pennsylvania's elder chapter, Pittsburgh, elected officers for the 1958 year at their November meeting. James A. Crenner, superintendent of buildings for the National Union Insurance Company, is the new president of the chapter. Vice-president is Edward J. Tessmer, engineer for Pittsburgh Brewing Company. Re-elected secretary-treasurer is Otto Knoch, assistant chief engineer of the Joseph Horn Company Department Store. President Crenner appointed retiring president Clyde Dalton as chairman of the educational committee. Dalton is the chief engineer of Pittsburgh Brewing where he succeeded Alfred Lossing as Chief last year when Lossing transferred to upstate New York.

At the meeting on December 12, Dalton gave a detailed report on the national convention. However, he did not notify the chapter that he had been appointed to one of the national committees which information reached the chapter after the December meeting. The members were pleased to learn that Dalton had made a berth on the National Publication Committee. This is the first appointment of a Pittsburgh member to a national committee since Lossing transferred from the area.

Watkins Presents Plant Improvements Talk

An illustrated presentation of "Automatic Defrosting Systems" was made by J. E. Watkins of The J. E. Watkins Company, Maywood, Illinois, before a joint meeting of the ASRE Pittsburgh Section and the NAPRE Pittsburgh Chapter, on January 13, 1958. Five methods of automatic defrosting were described and discussed. Conditions which produce frost were explained. The relationship of air temperature to frost accumulation was clarified. Emphasized by Watkins was the fact that pressurized plants, using the new low head pressure—low liquid pressure system, actually have greater quantities of defrosting heat available from discharge gas, than many plants which have been fighting to keep high head pressures.—Otto Knoch.

Yakima Elects Officers

YAKIMA—Officers elected at the Yakima, Washington Chapter for the new year are: President, Luther Stewart; Vice-President, W. H. Stanley; Recording Secretary, Galen Sutton; Financial Secretary, Elmer A. Toop; Sergeant-at-Arms, E. A. Wahlstrom. Lew Powers was again appointed chapter instructor. Powers is Field Engineer for Pacific Power and Light.

The chapter also voted to go back to two meetings a month. However, the first meeting will be given over to plant visits and speaker programs; whereas the second of the month will be devoted to an educational program.—Elmer A. Toop

(Continued on page 36)

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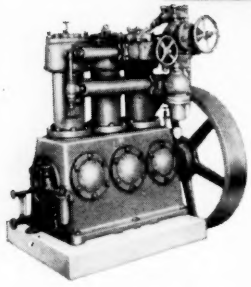

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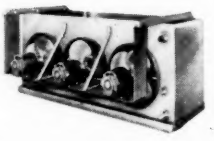

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Refrigerated Warehouses Hit Leasing of City-Owned Cold Storage Space

THE CITY of New York has been accused by Harold Riegelman of following "morally indefensible and legally improper" procedure in taking bids for a lease of city-owned cold-storage space in the Bronx Terminal Market. Mr. Riegelman, speaking as counsel for the Merchants' Refrigerating Co., said the city ought to close down the facilities because they constitute "disastrous" competition for private cold-storage facilities. He said that if the city insists on leasing out the facilities, it should be fair about bidding procedure.

He made his charge in the office of Markets Commissioner Anthony Masciarelli at 137 Centre St. as Mr. Masciarelli received bids for a five-year lease on the city's cold storage plant, a 2,300,000-cubic-foot facility at 151st and Exterior Sts. the Bronx. Mr. Masciarelli denied that there was anything improper about the bidding procedure, and said that the decision to lease the facility was made by Mayor Wagner's staff. He noted that the facility brings in $270,000 a year in rentals.

At the bidding ceremony, Mr. Riegelman dropped a written thirteen-page protest into the bidding box in behalf of his client. Two other cold-storage firms dropped in similar protests. Actual bids, accompanied by $25,000 security checks, were put in by the Manhattan Refrigerating Co., which currently is using the Bronx facility, and by the Manhattan company's parent company, the Union Terminal Cold-Storage Co.

Mr. Masciarelli recalled that the United States government had the facility until 1949, and that he advertised for bids for a new tenant but didn't receive any. Then, in 1952, he negotiated—without public bidding—a contract with Manhattan, which actually rented only a part of the building but had an option to use other space as needed. This lease expired December 31, and new bids received were for a new lease to replace it.

He disclosed that Manhattan offered to pay $300,000 a year in flat rental plus 10 percent of its gross receipts over $300,000 a year up to $600,000 a year and 15 percent of its gross receipts over $600,000 a year. Manhattan's parent firm offered a flat rental of $320,000 a year.

Mr. Riegelman described the 1952 lease as an "accordian" lease. He said that Manhattan had not entered a bid at the earlier public bidding because that was for the entire warehouse. He said that any company would be glad to get the "accordian" type of lease that Manhattan got. His chief points were that Commissioner Masciarelli waited until December 31, the day the Manhattan Co.'s lease expired, to advertise bids for a new lease; that Manhattan, as tenant, restricted inspections of the property by potential bidders; and that Commissioner Masciarelli had told potential bidders it might be as long as two years before the successful bidder could take over the facility from Manhattan.

He told reporters that he had won only grudging consent from the Manhattan Co. to permit inspection at all and that he couldn't legally have compelled the company as tenant to permit inspection; that he had personally notified all cold storage companies of the bidding.

Mr. Riegelman disclosed that on March 11, a group of companies had asked Mayor Wagner to close down the facility, charging that the city was renting the facility to the Manhattan Company at rentals so low "that the lessee has been able to sell and has sold those facilities at prices substantially under those at which the eleven privately-owned and operated plants can sell their space and meet their operating expenses."

Maine Potatoes to be Cooled

THE MAINE Potato Industry will be provided with pre-cooled refrigerator cars for a large percentage of their late spring shipments, the Maine Potato Council has announced. E. Perrin Edmunds, Council President, said this new development should be of material assistance in increasing the volume of Maine potatoes marketed in late May, June and July.

"There is a steadily improving demand for Maine potatotes in these months provided we can deliver them the way the trade wants them," Edmunds added. "Our problem has been high cost of icing. This new service, under which the Railroads will provide 5,000 lbs. of free ice, is a real break for the Maine Potato Industry. Now we can really go after our share of early summer business."

The offer of free pre-cooling service followed an appeal by Council officials to all originating carriers for assistance in increasing late season volume. All the originating carriers have expressed an interest in providing this service for their shippers. Although physical difficulties will prevent all carriers from participating this year, the Bangor and Aroostook Railroad, with icing facilities already established, will initiate a test program on approximately 2,000 carloads this year.

The Cost of Mishandling Frozen Foods

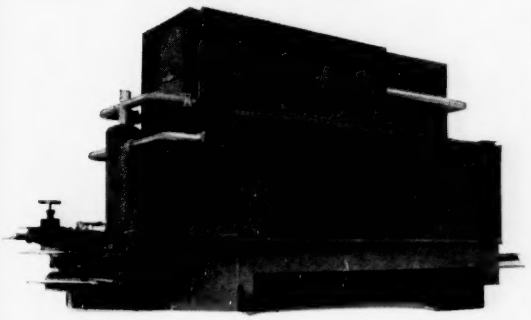
HOW MUCH does it cost in quality to mishandle frozen foods? That is the ultimate question that may be answered with data from the time-temperature tolerance project. Calculations reported by Dr. M. J. Copley at the recent ASRE Food Preservation Conference in Chicago, came closer to good sound estimates. The data obtained in the project have made possible a comparative estimate of two exposures reaching 10 F with two reaching 20 F. So far as time is concerned, the exposures represent what can easily occur in transport, as the first exposure, and what can easily occur in the later stage of wholesale and retail handling, as the second.

The comparison is between allowing the frozen food (strawberries served as the example) to reach 10 F and allowing the food to reach 20 F. As the project has shown, the rate of quality loss (vitamin C, flavor and color) increases very rapidly as temperature rises. The period of high-quality life is estimated to be the several weeks at 10 F in which taste panels are unable to detect quality change. With the 20-degree exposures, none of this quality period is left for the consumer; with the 10-degree exposures, the consumer gets a substantial portion of it.

Two Exposures Studied

The report points out, that only two exposures are considered, and that 10 F takes considerably more quality out of the strawberries than zero would take. This sort of thinking and calculating is, however, what is needed throughout the frozen-foods industry. Men with thermometers and dispositions to calculate will reduce losses of quality from mishandling. They will force the quality-losing exposures down to the zero point.

We know that protection of quality does increase sales in some sort of proportion to the extent to which quality protection increases. Costs and prices are involved in this fundamental equation. But let's remember that careful thinking, common sense, cooperation, thermometers, and improved management are not necessarily highly expensive. Experience gained is always a sound guide to progress.—TRRF Bulletin



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(Continued from Page 33)

Controls Featured At New York Meeting

NEW YORK CITY—Temperature control systems, as applied to any type of refrigeration system, were discussed by Steve Fabian and T. C. Kasmer, Minneapolis-Honeywell Regulator Co. at an early Fall meeting of Metropolitan New York Chapter, NAPRE. Fabian explained how the expansion of a gas within the bulb, capillary tube and bellows of a control instrument causes movement of a bellows or diaphragm to actuate a linkage to make or break electrical contact. Proper arrangement then can be made to provide required operation of equipment. He explained how proper choice of sequence controllers can vary the capacity of a given group of compressors, illustrating with the operation of a 5, 7½ and 10 hp. unit to be automatically controlled in increments of 2½ hp from 5 to 22½ hp.

The speaker pointed out the three basic types of control instruments with regard to the fill or amount of liquid provided in the capillary and tube system—the low temperature fill when the bulb is to be installed in a location normally lower in temperature than the instrument itself, the high temperature fill when the bulb is subject to temperatures normally higher than the instrument, and the cross ambient fill when a wide variation of temperatures between the two locations can be expected.

A brief discussion was held pointing out the difference between a temperature control device and a thermal control valve for refrigerant control. Though they both use the same basic principle of expansion of a gas for the operating force, a temperature control device is designed to actuate a mechanism at a given set point, while a thermal control valve is designed to meter the flow of a refrigerant so that the control point or bulb location nearly approaches the temperature of the coil at the inlet point.

This temperature can and does vary over a relatively wide range of operating pressures without affecting the operation of the control device. For this reason the bulb and capillary tube system of a thermal valve should be filled with the same fluid as that being controlled, or with a fluid whose pressure-temperate characteristics are nearly identical with the one being controlled. Conversely, a thermal valve designed for operation with one refrigerant will not control properly with a different refrigerant. In a temperature control device, the capillary system may be filled with any one of a number of fluids, ether, alcohol, etc., as long as the temperature-pressure characteristics are known for proper calibration of the instruments.

Metropolitan New York Chapter received its biggest boost in new member applications at the September meeting. Applications included engineers from the chemical industry, hotel operating, fire detection and control, warehousing, ice manufacturing, and from a practically public, private institution – Madison Square Garden. Chapter officers pointed this out to non-members and guests as additional proof that NAPRE caters to no particular industry, but to engineers who are interested in learning more about their particular jobs in refrigerating.—QUAID MINICH.

Expands Membership

Metropolitan New York chapter now extends from A to Z!! One of New York's first members, a member-at-large for several years and active in reorganizing is G. Lawrence Allan, chief engineer of the Hampshire House, a Kirkeby Hotel. At the December meeting an application was accepted from Theodore Zakrzewski (pronounced Zack-chef-ski), chief engineer, Shelton Towers Hotel. Alphabetically now, the 63 active members fill in between each letter.

Program chairman McCreery outlined the speaker program through March. Other discussions concerned the possibility of holding a National Convention in New York in the not too far distant future. By way of encouraging interest in this type of affair, Charles Larsen gave an excellent report on the recent National Convention in Chicago. Members from this area were urged to make plans to attend the 1958 convention in Miami.

Discussion of the educational program brought out the fact that a large percentage of New York membership agree that two meetings a month does not give adequate coverage of *Basic Refrigeration*. The secretary was instructed to poll the membership to determine how many members would attend weekly meetings, with one meeting per month being devoted to outside speakers or plant visits, the other meetings to thorough coverage of *Basic Refrigeration*.

Expansion Valve Lecture

Educational portion of the December meeting was an introduction to Expansion Valves, conducted by Hubert Hooper. Hugh started out with hand expansion valves, exhibiting a 1/2-inch valve brought along for the occasion. Details of construction were pointed out and the function of this type valve explained.

It was pointed out that the term "expansion", when applied to valves in this service, is a misnomer and somewhat misleading. The function of the valve is to reduce the pressure of the refrigeratnt from high side to low side (suction) pressure and to meter the flow of refrigerant so that the proper amount may be fed to the coil.

The hand expansion valve has many points in its favor; low first cost, long dependable life, low maintenance cost, ease of operation. Main objection to this type valve is that it is unable to adjust itself to changing load conditions and therefore requires the services of an engineer to make adjustments.

Next valve discussed was the "automatic expansion valve" which is essentially a pressure reducing device, diaphragm operated and sensitive to pressure changes in the evaporator coil. It may have a preset spring pressure above the diaphragm or be equipped with an externally adjustable spring that may be changed manually to meet changing load conditions.

As the pressure in the evaporator is lowered by the compressor, the spring pressure overcomes the pressure exerted on the lower side of the diaphragm and the valve opens, admitting more refrigerant. As the refrigerant evapo-

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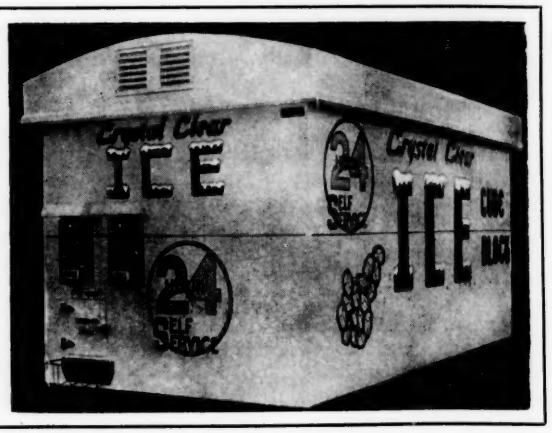

rates and increases the pressure in the coil (and under the diaphragm) the valve closes. Being sensitive the pressure changes only, the automatic expansion valve must be sized to a given load and a given compressor capacity, hence it's application is limited.

Thermal Units discussed

Next step in valve design is the thermo (or thermal) expansion valve. This valve is basically the same as the automatic expansion valve, except that the operating force is obtained from the pressure of a refrigerant contained in a bulb strapped to the suction line at the coil outlet. Since the pressure-temperature characteristics of the refrigerant can be accurately determined, the pressure at any given temperature greater than the saturaion temperature of the refrigerant in the coil will be known.

Therefore the valve may be calibrated to deliver only enough refrigerant to keep the coil supplied with an amount that will evaporate. Thus the valve becomes sensitive to heat rather than pressure and will accommodate a wide range of load conditions. However, the thermal expansion valve is not a temperature controlling device in that it will not maintain a predetermined air or product temperature. It is a liquid metering and pressure reducing device only. Much discussion centered around these three types of valves, details of their construction, installation and operation.

Alco Representative Appears

On December 18, Erwin Lodwig, Alco Valve Co., conducted the Educational Program. With the help of slides, Lodwig covered the theory of operation, design, installation and maintenance of all types of refrigerant controls, and with a complete refrigeration system equipped with bottom and top feeding expansion valves, back pressure controllers and other automatic flow controls operating on a glass evaporator, he demonstrated the manner in which each control does it's job. Members were able to watch the refrigerant through the entire expansion cycle and it cleared up a good many mysteries about what actually takes place inside an evaporator coil.—QUAID MINICH.

Tennessee Continues Course Tours Memphis Hospitals

MEMPHIS—Education, and instruction specifically in Basic Refrigeration, continues to be the prime objective of Tennessee Chapter No. 1, NAPRE. Each meeting, Instructor H. L. Todd continues a series of lectures on our official text, with one exception when President D. M. Platt substituted for Todd, who was out with the "flu". Chapter assignments at present have to do with compressor calculations.

Following the national meeting at Chicago, delegates from the chapter turned in a detailed report at the December 4 meeting. Members were pleased to note the re-election of C. W. Sullivan as a national director. Sullivan is a past president of the Memphis Chapter.

Institutional Tour

An interesting tour was arranged in October. Members were guests of the chapter president, D. M. Platt, who is the chief engineer of the City of Memphis Hospitals. In addition to inspecting some of the finest buildings and equipment needed for the hospitalization of the sick and injured people, Memphis members inspected closely a 1,000 hp boiler plant. Steam is used to heat the buildings, for cooking purposes and for water heating as well as surgical and hospital needs. Members were surprised to find over 2,000 tons of refrigeration were employed in the various hospital buildings. Heaviest tonnage, of course, is required for airconditioning, but the refrigeration of many food coolers and for ice making comes to a considerable figure.

Although built around the University of Tennessee Medical Schools, the hospitals in the group under Platt's engineering jurisdiction, are maintained and supported by the City of Memphis. Members were a little surprised but nevertheless pleased to learn that as citizens of Memphis they contributed much to this institution. Refreshments prepared in the hospital kitchens were served to the visitors.—CHAS. CONLEY.

(Continued on page 40)

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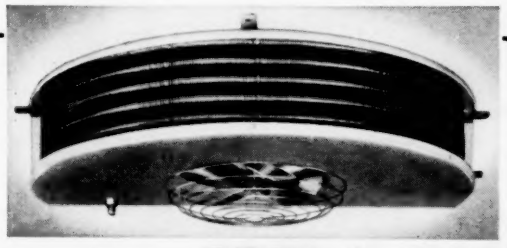

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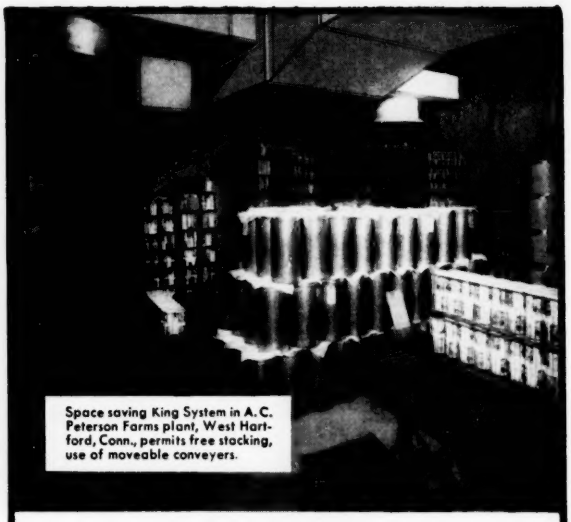
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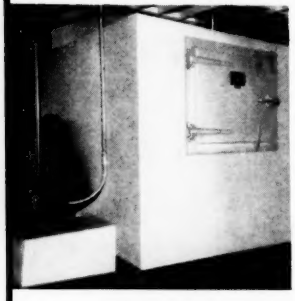

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Plant Sanitation In Refrigerated Warehouse

THERE is no formula for proper plant sanitation according to a bulletin of The National Association of Refrigerated Warehouses prepared by K. J. Sartori, National Ice & Cold Storage Co., San Francisco, Calif. It's something that everyone in the organization has to work at every hour of the working day. There are, of course, many steps that can be taken to make the job easier, and we will try to set down here some of the things we have done in our company to bring about what we consider an excellent program of plant sanitation, or more commonly called "'good housekeeping".

Group Responsibility

Although, as stated, good housekeeping is the job for all, from Chairman of the Board to Janitor, some person or group must be charged with the responsibility of policing the program. We operate a number of branches scattered throughout the State of California and the responsibility for the entire program is in the hands of a member of our General Office Operating Department, who in this case also happens to be our safety engineer. For expediency in getting proper policing and because we think the jobs go hand in hand, the branch programs have been made the responsibility of the permanent Branch Safety Committees.

All members of the Branch Safety Committees are on notice to report unsafe or unsanitary conditions to branch management immediately. The Safety Committees in their regular monthly meetings and inspections are required to make formal notification of such conditions, copy of such notifications being forwarded to the General Office Operating Department.

Cursory inspection of premises is made regularly by individual members of the General Office Operating Department, and a full scale inspection followed by a meeting of General Office Operating Department, personnel and Branch Supervisory personnel, is made quarterly.

Requires Education and Tools

Of course, plant sanitation also requires a continual program of education, and the availability and accessibility of the tools to do the job. The tools we do make available and accessible in quantity. Plenty of brooms, mops, dust pans and garbage cans, strategically located and clearly designated. Plenty of water outlets and drains, and in the larger plants one or more vacuum cleaners or rotary sweepers. And, of course, plenty of paint and paint brushes. The job of educating is carried on through our branch meetings of Supervisory personnel, safety meetings, pamphlets in pay envelopes and by the use of instructive materials placed on bulletin boards.

Actually, the items mentioned above, (organization, policing, education and available tools) are the keys to good program of plant sanitation. The oil to keep the locks working is "common sense" applied frequently. Without this last ingredient no program of good housekeeping will work successfully. With it, you'll never miss.

Refrigeration to Cool Concrete for Dam

A CONTRACT has been awarded the Lewis Refrigeration Co., Seattle, Wash., to design and furnish a refrigeration plant for construction of Glen Canyon Dam on the Colorado River. The plant will cost more than $900,000. R. E. Lucas, company manager, said the large plant is needed to cool concrete, which must be poured at a temperature of 50 degrees in the desert heat.

COMING CONVENTIONS

GEORGIA ICE MANUFACTURERS ASSOCIATION
February 25, 26, 1958
Biltmore Hotel
Atlanta, Georgia

SOUTHERN ICE EXCHANGE CONVENTION
February 25, 26, 1958
Biltmore Hotel
Atlanta, Georgia

INDIANA ASSOCIATION OF ICE INDUSTRIES
March 2, 3, 4, 1958
Marott Hotel
Indianapolis, Indiana

OHIO ASSOCIATION OF ICE INDUSTRIES
March 2, 3, 4, 1958
Marott Hotel
Indianapolis, Indiana

MICHIGAN ICE INDUSTRIES ASSOCIATION
March 2, 3, 4, 1958
Marott Hotel
Indianapolis, Indiana

NATIONAL FROZEN FOOD PACKERS
March 2-6, 1958
Conrad Hilton Hotel, Chicago, Ill.
Laurence Martin, Secretary

THE REFRIGERATION RESEARCH FOUNDATION
March 6-8, 1958
Adolphus Hotel, Dallas, Texas
H. C. Diehl, Director

NORTH CAROLINA ICE ASSOCIATION, INC.
March 9, 10, 11, 1958
Sir Walter Hotel, Raleigh, N. C.
Lewis H. Powell, Secy-Treas.

AMERICAN WAREHOUSEMEN'S ASSOCIATION
March 10-13, 1958
Adolphus Hotel, Dallas, Texas
Wm. Dalton, Secretary

NATIONAL ASSOCIATION REFRIGERATED WAREHOUSES
March 10-13, 1958
Adolphus Hotel, Dallas, Texas
Wm. Dalton, Executive Vice-Pres.

NORTHWEST ASSOCIATION OF ICE INDUSTRIES
March 13, 14, 1958
Davenport Hotel,
Spokane, Washington

VIRGINIA ICE MANUFACTURERS' ASSOCIATION
March 19, 20, 1958
Chamberlain Hotel
Old Point Comfort, Virginia

AMERICAN POWER CONFERENCE
March 26-28, 1958
Hotel Sherman, Chicago, Ill.
R. A. Budenholzer, Conference Director
3300 Federal St., Chicago 16, Ill.

MOUNTAIN STATES ASSOCIATION OF ICE INDUSTRIES
April 10-12, 1958
Hilton Hotel,
Albuquerque, New Mexico

CANADIAN WAREHOUSEMEN'S ASSOCIATION
May 12-15, 1958
Seigniory Club, Montebello, Quebec
H. Cecil Rhodes, Managing Director

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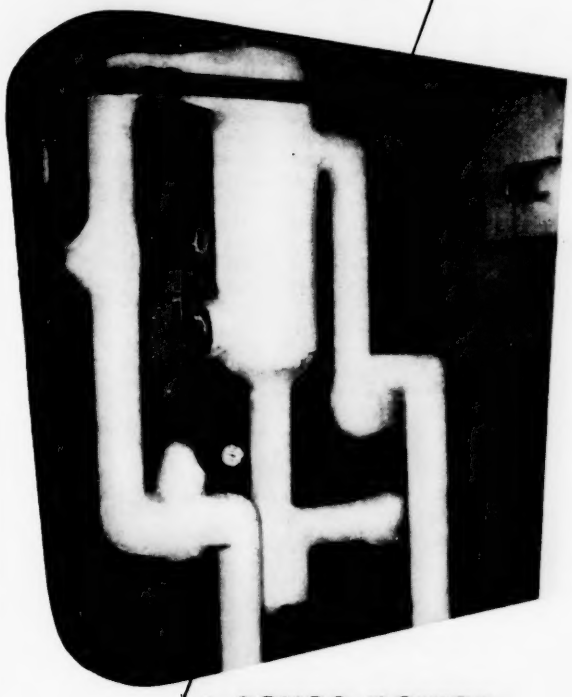

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(Continued from Page 37)

Mississippi Host to First '58 Conference

JACKSON—President Frank L. Chase, NAPRE, recently accepted the invitation from Mississippi Chapter No. 1 to hold a Southwestern Regional Educational Conference in Jackson. March 7, 8 and 9, 1958. Chapters in Texas (Dallas, Houston, Coastal Bend), Tennessee (Memphis), and Louisiana (New Orleans) are expected to participate. Three or four speakers, a chapter clinic and a social have been scheduled.

The meeting on December 17 was held open for the nominations and election of the 1958 officers. These elected were as follows: J. R. Thompson, president; Harold Armstrong, vice-president; William Singletary, corresponding secretary, Roy Stewart, secretary-treasurer; James McHann, sgt-at-arms. Chairman of the Board of Directors, A. G. Liss. Appointed Educational Chairman was Charles Warwick; Membership Chairman, Ray Benton; Public Relations, Charlie Williams; By-Laws, D. G. Sanders, and Co-Ordinator of the Diversified Activities Committee, Cecil Ward. The members selected to have the President elect and Chairman of the Board each choose an additional member to serve on the Board of Directors. The tellers for the elections were Harold Armstrong and Ray Benton.

The meeting was turned over to the Educational Chairman for a brief review of the chapter on expansion valves and to complete the study on this subject. The program was concluded by a very interesting demonstration of how to check and set the superheat adjustment of a thermostatic expansion valve in the field using a container of ice water, compound gage, and refrigerant cylinder in addition to the valve to be set or checked.—J. R. Thompson.

Dallas Schedules Fall and Spring Program

DALLAS—Alford's Refrigerated Warehouse continues to be the meeting place of Dallas Chapter, and members are grateful for the loan of these facilities for the chapter's educational purposes. Fall and Spring speaker schedule for the chapter was announced early in October as follows:

Preventive Maintenance by Mr. Obert K. Irvine.

Expansion Valves, Sporlan Valve Co.

Moisture Incorporated, Sporlan Valve Co.

Meehods Used in Figuring Power Consumed, Elliott Hollowell.

Manufacture, Installation and Servicing of Bearings, General Motors.

Water Treatment, Allis Chalmers.

Vapomatic Automatic Defroster, Snell Refrigeration Supply Co.

Dallas Chapter started the Basic Refrigeration course over again this year. It is a practice of the chapter to start the course about every three years. Some of the early chapter assignments were handled by Elliott Hollowell.

On the return from the National Meeting in Chicago, chapter delegates, Tom Weatherford and Virgil Young announced that the National Educational Committee, NAPRE, was making an effort to produce an elementary electrical course for refrigerating engineers. Young also announced that Weatherford had been elected a national director once again. Weatherford had served three previous terms as a director but had stepped down last year for reasons that he described as personal.

On January 6, Dallas elected its 1958 officer staff. New president is Anthony Higgs, Proctor & Gamble Co.; Vice-president is none other than Tom Weatherford, Texas Meat & Provision; Secretary is Virgil F. Young, Alford Refrigerated Warehouses, and Treasurer, John G. Swanson, U. S. Cold Storage Co. Instructor will be Elliott Hallowell, Snell Refrigeration & Supply Co.—W. A. Higgs.

Greater Kansas City NAPRE Installs Chapter Officers

KANSAS CITY—Retiring President Leland Kenagy, in a very impressive ceremony, charged and installed Kansas City Chapter NAPRE officers for 1958. These officers are President, Gregg Hale, Inland Cold Storage Co.; Vice-President, V. W. Crocker, Federal Cold Storage Co., Div. of City Products; Secretary, John Muller, Railways Ice & Service Inc., Div. of Southeastern Public Service Co.; Treasurer, J. L. Edwards, Armour & Co.; Sergeant-at-Arms, John Schwab, Central Packing Co.; Robert Clark, Inland Cold Storage Co. and Bill Maiden, DeCourley Creamery Co., Directors.

President Hale took charge of the meeting and immediately appointed D. D. Clarke, Jr., U. S. Cold Storage Co., chairman of the membership committee, and A. C. Boyd, Federal Cold Storage Co., chairman of the educational committee. It was agreed that Kansas City would, in general, follow the procedure of devoting the first meeting of each month to chapter business and study of chapter refrigeration course. The second meeting of each month would be devoted to outside lectures, demonstrations and tours.

Clearance Volumes and Compressor Efficiency

For his topic, the Instructor chose to discuss effect of clearance volume on compressor efficiency. A practical example was worked out using a 5 x 5-in. compressor operating at 15 psig suction and at 165 psig discharge. For theoretical purposes, it was assumed that both the suction and discharge gases were at saturated conditions. By calculations, it was shown that if there were no clearances in the compressor, 82 revolutions of the compressor would be required to move one pound of ammonia. Then by calculations, it was shown that as the clearance increased, more revolutions of the compressor would be required to move the same one pound of ammonia. Figuring the loss of efficiency due to the clearance volume *only*, it was noted that revolutions required for the various clearances were as follows:

Inches	Revolutions
1/64	82.25
1/32	82.8
1/16	83.1
1/8	84.3
1/4	86.6

It was then brought out that the volume of discharge gas which is collected and remains in the clearance pocket must be re-expanded to suction pressure during the downward stroke of the piston before additional gas could be drawn into the cylinder. Rough calculations were made to determine the loss of efficiency due to this re-expansion of the high pressure gas and it was noted that the following number of revolutions were required to move one pound of ammonia for the clearance as shown:

Inches	Revolutions
1/64	83.7
1/32	85
1/16	88.5
1/8	95.6
1/4	110.4

During the ensuing discussion it was pointed out that as the suction pressure was reduced and as discharge pressures were increased, the loss of efficiency was greatly increased. Ways and means of minimizing clearance and clearance volumes were discussed. At this stage of the discussion, it was pointed out that the example had been based on the assumption that the discharge gas was at saturated conditions, whereas in actual practice, it would be highly superheated and would have a theoretical temperature of 233 F. Time ran out before the affect of this superheated gas could be fully explored.—John G. Muller.

Mariakis Leads Members-at-Large

DUES remittances from members-at-large in NAPRE have been received at a very furious rate in the National office. It has been reported that the National Office has had some difficulty keeping pace since they are shorthanded. Therefore, this classification of members are requested to be patient and they will receive their membership cards and acknowledgments within a few weeks.

Among some of the first remitting were members like Allan W. Cox, Owens Corning Fiberglas, Toledo, Paul F. Northam, Miles Laboratories, Inc., Elkhart, Ind., Carl Nessler, Jr., Texas City, Texas, Lawrence J. Dooling, Chief Eng. Bay City Freezers, Mich., Walter Brittain, Crystal Ice Co., Ardmore, Okla., William D. Harrison of Riddleberger Brothers Plumbing Co., Harrisonburg, Va., M. G. Gabler of John Hauenstein Co., New Ulm, Minn.

Others of this "independent" class included: J. A. Gealta, Chief Engr. Utah

Brewing Co., Ogden, Eugene Binder, Refrig. & Air Cond. Mechanic, U. S. Army Valley Forge Hospital, Barto, Pa., William R. Robinson, President, The Ohio Galv. & Mfg. Co., Niles, Clyde Frampton, Burkhardt Brewing Co., Akron, Paul S. Toay, Plant Manager, Pacific Fruit Exp. North Platte, Nebr., Ray Hassel, Sales Manager, Henry Bower Chemical Mfg. Co., Philadelphia, Pa., Walter C. Wilkinson, Chief Engr., Hawaiian Tuna Packers, Honolulu, Gilbert S. Towslee, Engineer for Birds Eye Div. General Foods Corp., Walla Walla, Wash., Charles Coblentz, Mutual Ice Co., Alexandria, Va., Robert Chadima, Cedar Rapids, Iowa, and Francisco G. Westendarp, Mexico.

Thomas C. McQ. Douglas, London, paid 3 years dues in advance. Officers haven't figured out whether he had a financial windfall, or just insured himself against another raise in dues. Other members abroad who remitted: H. Agustin Reed, Gomez Palacio, Dgo, Mexico, Frederick G. Minister, Gen. Mgr. of F. C. Lovelock Pty., Ltd., Sydney, Australia, J. E. Vosbrugh, Asst. Supt. Engr. Broder Canning Corp., Lethbridge, Ala., Canada. Christmas cards were received from many members-at-large, including Shannon E. Yarborough, Jr., Port-Au-Prince, Haiti, one of the newest members, and W. J. Mikker, Columbus, Ohio, one of NAPRE's senior members.

It is a distinct privilege to be chosen vice president of NAPRE. It is hoped that your "jr. veep" can do as well as his predecessors have done. One project is that of picturing the positions of members-at-large in this column, for review by all members. If there are any pictures or interesting things about your plants, please send them to our National Headquarters or your second vice-president, so that these newsworthy items can be published in our official organ, INDUSTRIAL REFRIGERATION.—JOHN N. MARIAKAS.

Missouri Valley Recovers From Convention Defeat

ST. LOUIS—Representatives of the 49th State (St. Louis Metropolitan area) chapter, NAPRE, went all out to get the 1958 annual meeting in that city. It was disappointing when Chapter President Peter Orlando, Gurdon Uplinger, and other delegates returned with the news that St. Louis ran second. However the chapter served notice on other NAPRE units that it will be back stronger than ever next year in competition for the '59 affair.

Speaker of the evening of the November 20 meeting was Maury Hill, representative of Pittsburg Corning Corp. Hill presented a very interesting discussion on the product of his firm, Foamglas. His discussion included low temperature applications and vapor seal, plus a demonstration on moisture penetration, or "non-penetration".

The speaker added to his verbal presentation by showing a colored film entitled "Foamglas, the Foremost Insulation". Manufacturing processes, the physical properties and applications at various high and low temperatures were detailed in the audio-visual account. Wilson R. Hannebrink, vice-president, presided over this meeting in the absence of Peter Orlando, President, who was the chapter delegate to the convention.

Washington Chapters Elect Officers for 1958

TACOMA—Washington Chapter No. 2, NAPRE, elected the following members to office for 1958: President, Merle Halley, Operation & Maintenance Dept., Heidelberg Brewery; Secy.-Treas., Jim Bennett, Chief Engineer, Tacoma Ice Co.; Sergeant-at-Arms, Glenn Jenkins, Maintenance Chief, Tacoma Milk Producers. The new Educational Chairman appointed by the incoming President is Bill Palmer, Chief Engineer, Medosweet Dairies. Assistant Educational Chairman is Morton Paulson, Chief Engineer, Pictsweet Division, Stokely-Van Camp at Auburn.

Chuck Devine, Olympia chapter member who represented both Tacoma and Olympia at the recent National meeting made his report at the December gathering of the chapter. Bob Nelson gave a report on the proposed City of Tacoma elevator ordinance as an additional feature.—JIM BENNETT.

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Photo: Station 8' wide x 20' long, equipped with three vendors to sell 10# bags cubes; 25# cakes; and 25# bags crushed.

- Sparkling White Exterior
- Beautiful Streamlined Design
- National Rejectors Coin Mechanisms
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Ask about new Polar Basket-Vend Conveyors.

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Refrigerated Holdings Show Increase

REFRIGERATED holdings for food on December 31, 1957 were generally above the 1952-56 average for the date, according to the Crop Reporting Board of the U. S. Dept. of Agriculture. The exceptions to this were stocks of butters, American cheese and red meats. But, when compared with a year earlier, most food stocks on hand December 31, 1957 were lower than in 1956.

Warehouse holdings of turkeys on December 31, 1957 were down to 178 million pounds, a reduction of 42 million pounds from a month earlier and compared with 162 million pounds in storage the same date a year earlier. Stocks of frozen poultry declined to 319 million pounds by December 31. This quantity was four percent less than stocks of a year earlier but 15 percent larger than average for December 31. Reductions in frozen fruit and vegetable stocks were larger than average during December.

December 31 stocks of frozen fruits were reduced to 496 million pounds. By comparison, these stocks were 31 percent larger than average and 10 percent above a year earlier. Frozen vegetable stocks were almost one-third above average for December 31, with 885 million pounds reported in storage. A year earlier, frozen vegetable stocks totaled 858 million pounds.

Warehouse holdings of orange concentrate increased seasonally—two million gallons. The gain was one million gallons more than average. Stocks of orange concentrate at the close of 1957 totaled 18 million gallons, 29 percent more than average but three percent under a year earlier.

Meat Holdings

Holdings of red meats were slightly under 400 million pounds. Beef and pork stocks were considerably below the average for December 31 and the stocks of December 31, 1956. Beef in storage on December 31, 1957 totaled 133 million pounds while pork totaled 194 million. Stocks of butter at 87 million pounds were half the average quantity on hand for December 31 and compared with 25 million in storage a year earlier. American cheese stocks were 8 percent less than average and 7 percent under the stocks of a year earlier with 372 million pounds in storage on December 31.

Reductions in shell egg holdings left 211,000 cases in storage compared with 320,000 a year earlier. Frozen egg stocks were down 24 million pounds to 75 million by December 31. These holdings were 15 percent above average but 13 percent less than a year earlier.

Storage Occupancy

Utilization of cooler and freezer space declined during December. Cooler occupancy, at 55 percent on December 31, was down four points from the previous month. Compared with last year and the 5-year average for this date, cooler occupancy was down five and eight points, respectively. Regionally, cooler occupancy declined in all areas except in the West South Central where occupancy was up two points. The declines in cooler occupancy ranged from seven points in the East South Central to one point in the Mountain region. On December 31, freezer occupancy stood at 69 percent—down four points from a month earlier. Last year this date freezer occupancy stood at 74 percent while 76 percent is average. Freezer occupancy was down in all regions except New England where no change from the previous month was reported.

Book Review

REFRIGERATION, AIR CONDITIONING AND COLD STORAGE, 1st edition, published by Chilton Book Division, Philadelphia 39, Pa., 1232 Pages, 482 Illustrations, Price $17.50. For sale by Nickerson & Collins Co., or NAPRE, Chicago 44, Ill.

Refrigeration Air Conditioning and Cold Storage is recommended for supplementary reading for practical refrigerating engineers, according to review comments by the NAPRE Educational Committee. Members-at-Large and chapter members studying the Association's official text will find this book by Raymond C. Gunther, expands and elaborates on the material with which they are working in their association study course.

Refrigeration fundamentals and principles related to accessory equipment are explained clearly and simply for the student engineer or the more advanced practical man. The author has employed simple language and reduced most calculations to simple arithmetic. Each chapter opens with a study outline and concludes with a summary, which facilitates individual home study.

Chapters with considerable additional data or material not currently found in the official NAPRE text include the following: Chapter 7—Thermo Dynamic Function; Chapter 10—Prime Movers, fans and pumps (including fundamentals of electricity and electric motor applications); Chapter 13—Secondary or Indirect Refrigeration) (with considerable emphasis placed on water and water chemistry); Chapter 15—Lubrication; Chapter 16—Refrigeration Systems (including thermo dynamic data on 2-stage systems, descriptions of steam jet systems and a review of the absorption systems found in the refrigerating field).

The author Raymond C. Gunther is a graduate of Pratt Institute, a teacher and a lecturer. Presently with Socony Mobile Oil Company, he had previously been with a division of Carrier Corporation. During World War II he was also in charge of the Refrigeration School at Fort Lee, Virginia, and served as refrigeration and cold storage officer in the Panama Canal Zone. He is a member of ASRE.

INSULATION REVIEW, published by Technical Productions (London) LTD. London, S.W. 7, England. 46 pages. Price 4 issues—$4.00—12 issues—$8.00. Sample Issue Offered.

Insulation Review is the first British journal entirely to all aspects of thermal and acoustic insulation selection, testing, installation and application. It is of special interest to architects, builders, contractors, public works operators, plant engineers, refrigeration and cold store engineers, and all those concerned with achieving the greatest efficiency in avoiding heat losses in every industry. Insulation Review is a link between manufacturers and users in every field of application of insulating materials.

Poultry Processing Plant

PLANS for a new poultry processing plant in Springdale, Ark., near Little Rock were announced by the Edgar Aaron Corporation and the United States Cold Storage Company. The plant will have a daily capacity of 40,000 birds. Plans called for construction to begin November 1957.

The plant will employ about 150 persons. It will be located north of Springdale on Highway 71 at a site provided by the Springdale Industrial Development Commission.

Changes in Frozen Foods

NEW knowledge of changes that may occur in frozen foods between the processing plant and the consumer has been developed by the Western Utilization Research Laboratory, U.S.D.A., Albany, Calif. The experiments involved studies of the effects of storage time and temperature levels on a variety of frozen products.

DEATHS

Fred T. Brandt

RESULTING from a stroke, Fred T. Brandt, refrigeration consulting engineer, Chicago, died January 6. Following his retirement as president of Westerlin & Campbell Company September 30, 1954, Mr. Brandt had opened an office at 1005

Fred T. Brandt

West Belmont Avenue, Chicago, and engaged in consulting work in connection with industrial refrigeration. He had been with Westerlin & Campbell for over 30 years covering the seven midwestern states as contract representative for York Corporation.

Throughout the years he kept in close touch with the midwestern refrigeration industry through talks to many national and local groups. He was a member of NAPRE and had recently assisted the new Fruit Belt Chapter at Benton Harbor, Michigan, especially with their educational program. He had been active with the Chicago Chapter as convention host when the Association met in that city last November. He is survived by his widow, Ethel, a son, Fred T. Jr., and two grandchildren. He was 70 years of age.

Jacob H. Betz

THE DEATH of Jacob H. Betz, secretary-treasurer of Mollenberg-Betz Machine Co., Inc., Buffalo, N. Y. occurred December 4. He was 61. Mr. Betz had been with Mollenberg-Betz since 1912 and had had charge of the machine shop division. He started as an apprentice machinist and became superintendent and general manager about 1940. He served as secretary-treasurer since the death of his father in 1953.

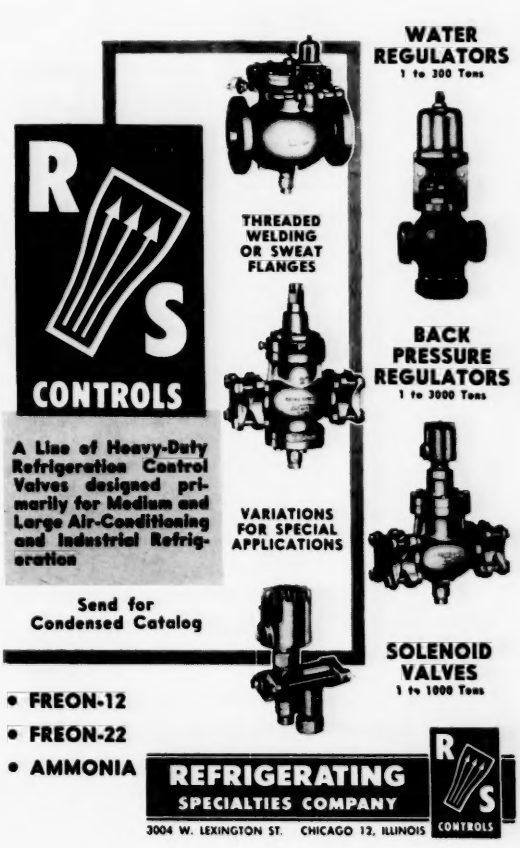
DENNIS C. LILES, 50, retired executive of the Merchants Refrigerating Co., Buffalo, N. Y. died December 15. He was a former manager of the company's two Buffalo warehouses, retiring about six months ago. Mr. Liles was associated with Merchants about 27 years.

HENRY M. WELLS, for 15 years a refrigeration engineer for The Merchants Refrigeration Company, Newark, N. J. died November 29. He was 60.

JOHN B. MCGUIRE, engineer at the Tupelo Ice & Coal Co., Tupelo, Miss., for thirty years, died December 6 of a heart attack. He was 74.

News of PEOPLE

CHARLES N. BROADKUS has been elected president and general manager, and George M. Sayre, vice-president and treasurer of the Cassco Corporation and Cassco Berkeley Corporation, Harrisonburg, Va., cold storage and ice service. The elections followed retirement December 31 of Joseph C. Epley, president and general manager.



Robinson Elected Chairman of American Ice

JOSEPH S. ROBINSON has been elected chairman of the board of American Ice Co. New York. Mr. Robinson, the largest individual stockholder in the company, takes over the post that has been vacant since the death of Charles C. Small in May, 1956.

In addition to Mr. Robinson, three other directors were elected. They are John P. McGrath, trustee of East New York Savings Bank and former corporation counsel of the City of New York; Earl J. Carroll, president of General Atlantic Co., a private investment firm, and Victor D. Lindeman, formerly executive head of Lindeman & Co., one of the largest coal and fuel oil distributors in New Jersey. The new directors replace on the board Harry Borns, Earl J. Barton, John H. G. Pell and Herman Jaeger.

Mr. Robinson said at the meeting of the new board that a continuation of growth in both sales and earnings is expected this year. He added that among steps to improve operations are plans calling for American Ice to make more profitable use of its large unmortgaged real estate holdings in several Eastern seaboard cities. No changes are at present contemplated, Mr. Robinson stated, in the company's operative and managerial personnel.

DAVID H. SANDERS, Omaha, Nebraska, has been named Vice President in Charge of Warehousing Operations for Ocoma Foods Company, as announced Monday by Ocoma president, Henry Kohorn. Mr. Sanders continues as manager of Omaha Cold Storage Co., a wholly-owned subsidiary of Ocoma. He was named manager of cold storage facilities and operations last August after serving for five years as assistant manager. He has been with Ocoma Foods Company since 1947.

JERRY P. JOHNSON for many years with the Terminal Refrigerating & Warehouse Corp., Washington, D.C., and more recently with the Merchants Refrigerating Co., New York, has retired from active industry activities. Among his other industry activities Mr. Johnson is a past president of the National Association of Refrigerated Warehouses.

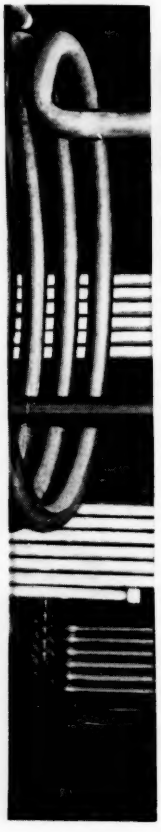
LEVEN J. TURNER has been elected vice-president and general manager of The Chattanooga Warehouse & Cold Storage Co., Chattanooga, Tenn. Mr. Turner previously had been assistant general manager of the warehouse and cold storage company. He also is treasurer and general manager of the Chattanooga Food Terminal and will continue in that post.

ROBERT C. HIBBEN, for many years executive secretary of the International Association of Ice Cream Manufacturers, has joined Fairbanks Associates, Inc., management consultants with headquarters in Greenwich, Connecticut, and beginning January 1, 1958 will be the resident manager of the firm's Washington, D. C. office, located in the Barr Building, 910 Seventeenth Street, N.W. A native of Iowa, and a graduate of Iowa State College, Mr. Hibben has long been a resident of Washington, D. C.

Refrigerator Cars Needed By Italian State Railway

AN association of organizations interested in the Italian refrigerator car problem has been established in Milan for the purpose of developing additional railway refrigerator cars for Italy's railway network. The organization grew out of a meeting sponsored by the Milan Chamber of Commerce for a study of the problem of inadequacy of the existing 6,000 refrigerator cars for present and prospective requirements of the Italian fruit, vegetable, and food industry.

It is estimated that another 1,500 reefers could be fully employed within the next year and that a further 4,500 cars will be needed by 1964. Italian State Railways will undertake no more than a token increase of the refrigerator car pool, and it is recognized that the only effective solution of the problem is the construction of privately owned reefers that could be used on the national railway system.



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MANUFACTURERS' NEWS

Byers Introduces Own Line Of Polyvinyl Chloride Pipe

WORLD'S LARGEST producer of wrought iron, A. M. Byers Co., Pittsburgh, announced last Fall a brand new addition to its product line—*Rigid Unplasticized Polyvinyl Chloride Pipe.* Byers states it is able to furnish this high quality thermoplastic pipe in any quantity. Field representatives, coast to coast, have received comprehensive training in PVC pipe engineering and are fully qualified to furnish detailed information on how PVC pipe can best serve the industrial refrigeration field.

An illustrated catalog on Byers PVC pipe is available upon request. Catalog contains complete engineering data, detailed information on applications and installation, and other information particularly useful to pipe specifiers and users. Byers is more than just another source of supply for PVC pipe, according to Company releases. Their wide experience in the field of corrosion-resistant pipe is supplemented by the vast plastic research facilities and manufacturing know-how of General Tire and Rubber Co., Byers majority stockholder.

Kelly Joins Dyfoam

LEO T. KELLY, long associated with the cold storage and insulation field, has been appointed sales representative of the Dyfoam Corporation, New Castle, Pennsylvania, manufacturers of Dyfoam lightweight, expanded polystyrene insulation. Mr. Kelly will service the Middle Atlantic States. His office will be located at 530 Sixth Avenue, Pittsburgh 19, Pa.

Carrier Promotions

THREE promotions in the Machinery and Systems Division of Carrier Corporation have been announced by Charles V. Fenn, vice president.

William H. Macdonald has been named assistant manager of the machinery department, a new post. Succeeding him as product specialist of industrial air and gas compressors at the company's Syracuse, New York, headquarters

Wm. H. Macdonald

Frank M. Fives

Clark T. Shields

will be Frank M. Fives, who was senior sales engineer for this equipment in the New York regional office. Clark T. Shields will move from the Chicago office to take over sales of these products throughout the northeast. Mr. Macdonald will assist Elbridge Gammill, machinery department manager, who is in charge of engineering and production of absorption, centrifugal and the reciprocating refrigeration units.

Gifford-Wood Takes Over Staatsburg Ice Tool

THE GIFFORD-WOOD Company and Staatsburg Ice Tool, effective January 1, have been merged under the ownership of Gifford-Wood. The president of Staatsburg Ice Tool George Bodenstein will serve us as a consultant; and both lines will be made and sold from the Gifford-Wood factory in Hudson, N. Y.

Until further notice the catalogs and price lists for both companies remain as is. Later in 1958 the company expects to publish a combined catalog which will offer the widest line of quality ice tools anywhere available.

Recold to Open Georgia and New Jersey Warehouses

IN CONJUNCTION with its Silver Anniversary expansion program, the Recold Corporation of Los Angeles is opening warehouses in Georgia and New Jersey. The Georgia warehouse will be located in Atlanta and a specific location for the New Jersey warehouse is currently in the process of being selected. Both warehouses will be operated by men who have been trained in factory operation, detailed direct from the Recold headquarters in Los Angeles.

Armstrong Subsidiary

A WHOLLY owned subsidiary to be known as Armstrong Contracting and Supply Corporation is being formed by Armstrong Cork Company to handle all contracting operations now carried on by its Insulation Division, Company President C. J. Buckstrand announced.

J. W. Liddell

Armstrong will continue its Insulation Division under General Sales Manager A. E. Pearce, to be responsible, as heretofore, for the outright sales of the Company's full line of insulating materials through established distribution channels. The Insulation Division will conduct its present contracting operations until January 1, 1958, when it will be taken over by the new subsidiary. Approval for the new subsidiary, which will be headed by J. W. Liddell as President, was given by the Board of Directors at its regular meeting in Lancaster, Pa., today.

The new Company, to be incorporated in the State of Delaware, will have its headquarters in Lancaster County. The subsidiary will draw its personnel from the Insulation Division and General Office of the parent Company.

Trane Awarded Contract to Cool Fresh Produce Cars

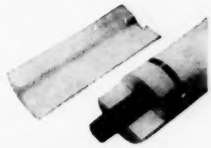
THE Trane Company, air conditioning and heating equipment manufacturer, has received a contract to provide complete refrigeration systems for 300 refrigerator cars of Pacific Fruit Express, San Francisco, H. C. Rooks, Trane vice president, disclosed. These cars will be used primarily for protection of fresh vegetables and fruits at specific, above-freezing temperatures.

Prior to this time, the firm utilized iced cars exclusively for moving fresh produce. The firm does have mechanically refrigerated cars for transporting frozen foods.

According to Rooks, "Trane currently is testing and developing specialized air conditioning equipment designed to meet many specific problems. The special units to be used on PFE cars are a result of that program—units developed by Trane to meet rigid conditions as designated by PFE."

The Trane refrigeration system minimizes the major problem of load dehydration by providing exacting, pin-point temperatures up to 70 degrees. This is essential in transporting perishable commodities. The system centers around a 7-1/2 ton capacity Trane compressor-condenser assembly and features completely automatic controls. Heating is also provided when necessary such as during cold winter months or while crossing snow-capped mountainous regions.

Here's Real News In Pipe Covering by Glo-Brite!



GLO-BRITE STYROFOAM* PIPE COVERING

for all low temperature and cold water line pipe covering. All sizes from 1/4" thru 16" pipe & tubing. Perfect Vapor Barrier. Quick, easy to apply. 36" lengths—featherlight. No outer covering needed.
* ®

See your distributor, or write,

glo-brite PRODUCTS
6415 N. CALIFORNIA AVE.
CHICAGO 45, ILLINOIS
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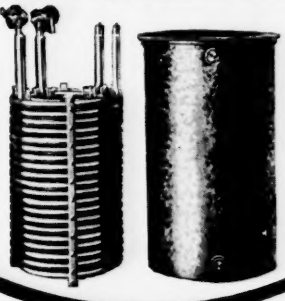
ECONOMIZE! STANDARDIZE! on "Rempe" PIPE BENDS AND COILS FOR REFRIGERATION

Rempe Shell and Coil Assembly for sub-zero or high temperature heat transfer.



In Rempe Coils you get Top Engineering and Quality Construction — the best in Refrigeration Equipment for long-life and low maintenance.
For Ammonia or Freon. All materials — Stainless Steel, Copper, Steel.

REMPE COMPANY
348 N. Sacramento Blvd., Chicago 12, Ill.

"Freon's" Thompson Retires

AFTER more than 25 years with the Du Pont Company, the last nine years of which he has been director of sales for its "Freon" Products Division, Robert J. Thompson, one of the nation's pioneer refrigeration sales engineers retired in December.

A native of Arcanum, Ohio, Mr. Thompson's career in refrigeration has spanned nearly 40 years, beginning with the General Motors Corp's program for development of household and commercial electric refrigerators in the early 1920's. He was named a commercial sales engineer for General Motors "Frigidaire" Division in 1925 and represented it in Europe, South Africa, and the Middle East from 1927 until 1931. At that time he joined Kinetic Chemicals, Inc., a jointly owned subsidiary of General Motors and the Du Pont Company which had been established to develop "Freon" fluorinated hydrocarbon refrigerants.

New Borden Division

FORMATION of a new division of the Borden Company has been announced by Harold W. Comfort, president. The newly created division is to be known as Borden's Milk & Ice Cream Company. It will unite Borden's milk and ice cream operations into one company entity.

Francis R. Elliott, vice president of the Borden Company, has been named president of the new division. Harry L. Archer, general manager of ice cream operations, becomes its vice president. The directing board will include Mr. Comfort, Roy D. Wooster, executive vice president of the Borden Company, the new division's two officers and chairmen of the Company's fluid milk and ice cream districts.

Sporlan Minneapolis Office

IN ORDER to increase its service to customers in the North Central area, the Sporlan Valve Company has expanded its Chicago office to include a sales office in Minneapolis, Minn., it has been announced. Malcolm L. Moore, formerly in Sporlan's St. Louis Sales Department, has been moved to Minneapolis to take over the new office.

M. L. Moore

New Bower Distributors

THE following distributors of Bower Brand Anhydrous Ammonia have been appointed by the Henry Bower Chemical Manufacturing Co., Philadelphia, Pa.

Baker Sales and Service Company, Utica, New York area; Munford Engineering Company, Central and South Mississippi; Lehigh Valley Chemical Company, Easton, Allentown, Reading area.

Dow Chemical Adds Unit

THE DOW Chemical of Canada is building a new plant at its Sarnia, Ont., site for first Canadian production of polystyrene foam. The new product will be processed from polystyrene—already produced by Dow. The product will be expanded to produce a sparkling white, non-interconnecting cellular structure, to include light weight, low thermal conductivity, inherent water resistance and high compressive strength.

Polystyrene foam has found wide acceptance for a variety of applications: as a low temperature insulation material in home building and in industry as a perimeter insulation and plaster base material.

New Atomic Submarines

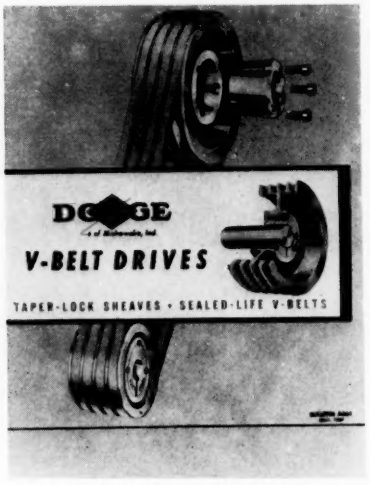
REFRIGERATING equipment for air conditioning seven new U. S. Navy atomic submarines will be supplied by Carrier Corp., Charles V. Fenn, vice-president, announced. Six of the seven underwater craft will be of a new class incorporating a "tear drop" or fish shaped hull, and the other will be a guided missile submarine.

With the addition of contracts for these new submarines, Carrier is now providing the cooling for 13 of the 14 under construction, Mr. Fenn said. Previous Carrier equipment orders include those for the Nautilus, Seawolf, Skate, the recently-launched Swordfish, and two of her sister ships.

CATALOGS AND BULLETINS

V-Belt Engineering Manual Offered by Dodge

DODGE Manufacturing Corp. recently introduced a separate V-belt drive manual containing all V-drive information previously available in the company's full-line D-56 General Engineering Catalog. Tables have been expanded to include more pre-engineered drives. Descriptive material is illustrated with product installation photographs. Engineering drawings and exploded views illustrate technical sections of the bulletin, indexed for convenient reference.



Dodge Manual on V-Belt drives

This 108-page comprehensive manual is designed to assist plant engineers with power transmission problems. Its 8½ x 11 inch pages are arranged in sections covering standard, variable speed and special drives, Taper-Lock Sheaves, Sealed-Life V-Belts, and Taper-Lock Bushings and Hubs. Other tables give horsepower capacities, belt speeds, center distances, sheave diameters, and other data. The manual is available to readers upon request from Dodge Manufacturing Corp., Mishawaka, Indiana.

Food Freezing Systems Discussed in Reprint

FOUR improved packaged food freezing systems—designed to meet the increased demand by frozen food processors for high volume, quality production at low processing costs—are discussed in an eight-page reprint of a technical article now available from Feezing Equipment Sales, York, Pa. Six factors to consider in making a freezer selection are given. Four photographs and three drawings are used to illustrate the material.

The four systems described are autoloading plate froster types, hydraulically operated buggy tunnels, staged belt freezers and high capacity automatic package freezers. Operation of each system is described and the step-by-step freezing and packaging processes discussed. Solutions to problems of space, economy and materials handling in packaged food freezing installations are offered.

Ship Dehumidification

A PAPER on ship dehumidification systems given at the meeting of the International Institute of Refrigeration at Nantes, France, June 20, 1957, has been issued by Desomatic Products Inc., Falls Church, Va. The paper was written by Gunner C. F. Asker and Thomas H. Urdahl. It presents a discussion of automatic and ship dehumidification systems, concluding with the statement that for cargo and ship preservation, recent equipment developments ashore lend themselves to adoption afloat for compact trouble-free operation in all kinds of weather.

Industrial pH Handbook

PROCESS Instruments Division, Beckman Instruments, Inc., announces the availability of "The Industrial pH Handbook". This 80-page work was compiled and edited by Thomas J. Kehoe, Application Engineering Supervisor. The handbook reviews industrial pH control systems, their principles, application engineering and equipment, providing a convenient reference source on pH for persons involved in designing, engineering, purchasing, and operating industrial pH systems. Systematic subject organization plus alphabetical indexing makes for easy reference to the subjects covered. The handbook contains approximately 100 illustrations, plus charts, tables, and a bibliography of reference literature on pH measurement. For copies of the handbook, write to Beckman Process Instruments Division, Fullerton, California.

New Bulletin Describes Zeolite Water Softener

CYCLES OF OPERATION (four steps) are described in a new bulletin on sodium zeolite water softeners released by Allis-Chalmers Mfg. Co., Milwaukee. Bulletin explains how standard units in sizes to 120-in. diameter can be easily adapted to meet plant requirements for hospitals, institutions and hotels. Design flexibility permits selection of a variety of features, including automatic operation and zeolite materials to meet local water characteristics. Copies of "Allis-Chalmers Sodium Zeolite Water Softeners," 20B7107A, are available on request from Allis-Chalmers, Milwaukee 1, Wis.

Jacket Water Bulletin

HAERING'S Technical Service Bulletin, H-O-H Data Sheet No. 730, lists factors that influence corrosion in compressor and engine cooling systems; discusses cylinder liner failure due to pitting, and impairment of cooling because of accumulation of corrosion products; gives the characteristics essential to a good corrosion inhibitor; includes recommended practices to control corrosion in mobile and stationary engine and compressor cooling systems; and may be obtained, without charge, from D. W. Haering & Co., Inc., San Antonio, Texas.

Catalog on Brass Valves

A NEW 20-page catalog R-6 giving size and application data for a complete line of refrigeration and air conditioning brass valves, accessories and fittings, has been issued by Superior Valve and Fittings Company, Pittsburgh, Pa. Incorporates recent technical data on ASME approved relief valves, hermetically fused sight glasses and high capacity heat exchangers.

Bristol Bulletin

A COMPLETE list of all Bristol products has been issued by The Bristol Company, Waterbury, Conn. (Bulletin W-1805), together with additional data including list of branch officers and associated companies, officers and department heads, trade names used by the company, product classification list, condensed listing of products and condensed listing of the industries that Bristol makes instruments for.

VAN RENSSELAER
H. GREENE
ENGINEERS

COMPLETE PLANT DESIGNS
INCLUDING BUILDING AND
EQUIPMENT

11 PARK PLACE NEW YORK 7, N. Y.

Classified Advertising

All classified advertisements are payable in advance. Except for Positions and Help Wanted classifications, this section is reserved exclusively for USED equipment.

RATES: 20c per word; minimum 25 words. $2.00 per line for bold face headings; $15.00 per inch for line listings.

Position and Help Wanted

WANTED—experienced sales engineer; salary and expenses. Contact Central Ice Machine Company, 5014 South 24th St., Omaha 7, Nebr., Phone Market 4690.

WANTED — MANUFACTURER'S REPRESENTATIVE with experience in refrigeration field. Territories available for revolutionary new discharge and suction valves for heavy duty industrial compressors. A tested and proven product that can be handled alone or with other lines. Write Box 333, % Industrial Refrigeration.

USED EQUIPMENT—wanted & for sale

WANTED—Gifford-Wood 300 or 400# block cubing machine. Also 400# ice cans. Write full description to Duty Ice Co., 724 South High St., Akron 11, Ohio.

FOR SALE — Refrigeration equipment; ice equipment; new, used. Advise us your needs. Use "QUICKSEAL" — stops brine tank leaks; easy, efficient, economical. Born Company, 80 East Jackson Boulevard, Chicago 4, Illinois. WAbash 2-3299

TURN BACK TO page 7 of this magazine if you want to see the first real advancement in compressor valves—the new Ball Valves.

FOR QUICK SALE
Special Offering Subject Prior Sale

Complete 12 can pull, 70 ton ice plant, maintained in top condition. Can be seen in Operation. Owner wishes to retire. Asks $12,000. f.o.b. middlewest, this includes dismantling and loading. Plant is near water. Can be loaded on barge for cheap freight. Born Company, 80 E. Jackson Blvd., Chicago 4, Ill. WAbash 2-3299.

FOR SALE—8x8 York, overhauled, $350.00. 1—20" x 10 ft. receiver. 3 ton ammonia blower. Valves ½ price. Write E. Niebling, 1546 St. Clair Ave., Mt. Healthy, Cincinnati 31, Ohio.

FOR SALE
FORT PITT BREWERY EQUIPMENT

Complete modern 750,000 bbl. brewery, operated until 30 days ago, equipment now being sold piecemeal. 3 Frick 116-ton each evaporative condensers, installed new 1955; Vilter 10½x10½ 2-cylinder ammonia compressor with Westinghouse 125 h.p., 60/220/3 phase, 275 r.p.m. motor, panelboard and controls; Frick Type HB 5 x 5 self-contained unit with AC motor; 3 Frick 12¼ x 21 Type J compressors with Skinner steam engines; scores of individual room blowers, coolers, thousands of feet of ammonia pipe, valves and fittings; everything erected as last used; priced ridiculously low! Inspection invited, complete details at CHAS. S. JACOBOWITZ CORP., % Fort Pitt Brewery, Sharpsburg (Pittsburgh) Pa., Telephone Sterling 2300.

FOR SALE — Complete 15 ton Frick Ice Plant, erected new 1947. Good condition; $6,000.00 f.o.b. cars North Carolina. Born Co., 80 East Jackson Blvd., Chicago 4, Ill. WAbash 2-3299

RED TOP BREWERY, CINCINNATI, CLOSES

This plant opened 1955 at cost of $250,000; everything to be sold at ridiculously low prices immediately. Frick 9 x 9 ammonia compressor, G.E. 60 h.p., 220/440, 3 phase AC motor, starter and controls; 3 Carrier cold air diffusers with AC motors; 2 York 100-ton each evaporative condensers, etc. Inspection invited or write to CHAS. S. JACOBOWITZ CORP., % Red Top Brewery, 242 W. McMicken Ave., Cincinnati, Ohio, Telephone Cherry 1-3400.

FOR SALE

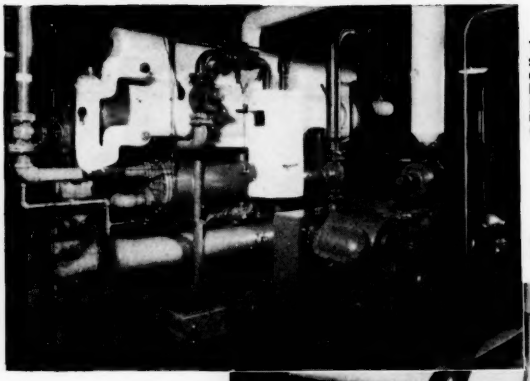
10x10 York Model D8 125 h.p.
9x9 York Duplex Model D8, 360 r.p.m. 200 h.p.
10x7½ & 8x6 York Model D8 boosters.
7½x7½ York w/V-belt drive 50 h.p. motor.
300 h.p. Westinghouse starter, 4160 V. (new).
100 h.p. 1200 r.p.m. GE motor w/starter.
(3) 38"x17' York shell & tube condensers.
10x10 Ingersol Rand air compressor.
(3) open end shell & tube brine coolers with 135 2" tubes 12' long.
6x6 York w/condenser with two water coolers 500 GPM.

JOHN F. CARSON
A & Venango Sts. Philadelphia 34, Pa.
GArfield 6-2221

FOR SALE—AMMONIA

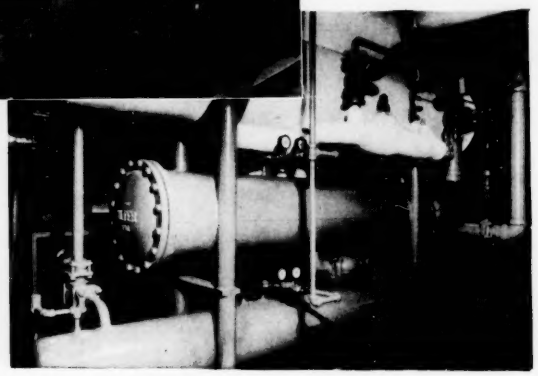
4—10"x10" 4-cyl. York duplex D. C. to 225 h.p. motor.
2—10"x10" 2-cyl. York D.C. to 100 h.p. motor.
1—9"x9" 2-cyl. York D. C. to 75 h.p. motor.
4—9"x9" 2 cyl. Frick compressors.
1—7¾"x5" Frick booster.
2—7½"x7½" 2-cyl. York compressors.
1—5¼"x4¼" 6cyl. V/W York booster compressor.
1—5"x5" 2-cyl. York compressor.
1—3"x3", 1—4"x4", 2—5"x5 condensing units.
11"x22"x47"—11"x22"x51 ice cans.
From 20 to 100 ton ice plants, York & Frick.

ENTERPRISE EQUIPMENT CORPORATION
79 Alexander St. Box 502 Yonkers, N. Y.
Cable "ENEQCO" Phone Yonkers 8-8118-9



This Vilter air conditioning plant consists of a Freon shell and tube water chiller, shell and tube condenser, liquid receiver and a six-cylinder Freon VMC compressor, all installed in the Southwestern Bell Telephone Co., Olathe, Kansas.

Close-up view of Vilter condenser. Chiller is above. Receiver is below.



Custom-made CLIMATE

for busy office and toll switchboard

Vilter has brought the latest in "custom climate" air conditioning to the general offices and toll switchboard of the Southwestern Bell Telephone Company, Olathe, Kansas. Happier employees and more efficient operation is the satisfying result. Vilter equipment includes a: 6-cylinder Freon VMC compressor, 16" x 10' water cooler, 16" x 7' shell and tube condenser, 12" x 10' receiver.

All components in a Vilter air conditioning system incorporate the latest in engineering skill and industry practice. VMC compressors offer maximum capacity in a minimum of space. Built-in capacity reduction permits automatic operation at reduced loads with consequent power savings. Vilter's wide range of shell and tube equipment is right in performance and right in price.

Vilter also offers a completely "packaged" water cooler—the Vilter Uni-Chiller. Shop assembled for lower first cost, the Uni-Chiller offers space-saving design, simple installation and requires a minimum of maintenance.

You, too, can have all the advantages of modern air conditioning and refrigeration—specify Vilter.

Equipment furnished by O'Dower Engineering Company, Vilter Distributor in Kansas City, Missouri. Mechanical Contractor, U. S. Engineering Company, Kansas City, Missouri.

Write for these helpful bulletins to The Vilter Manufacturing Company Dept. H-715, 2217 S. First Street, Milwaukee 7, Wisconsin

Bulletin 707
Vilter Condensers
Brine Coolers
Heat Exchangers

Bulletin 631
Vilter
Uni-Chillers

Bulletin 429
Vilter VMC
Freon
Compressors

Vilter®

REFRIGERATION and AIR CONDITIONING

THE VILTER MANUFACTURING COMPANY, Milwaukee 7, Wisconsin

Air Units • Ammonia & Freon Compressors • Booster Compressors • Baudelot Coolers • Water & Brine Coolers • Blast Freezers • Evaporative & Shell & Tube Condensers • Pipe Coils • Valves & Fittings • Pakice & Polarflake Ice Machines

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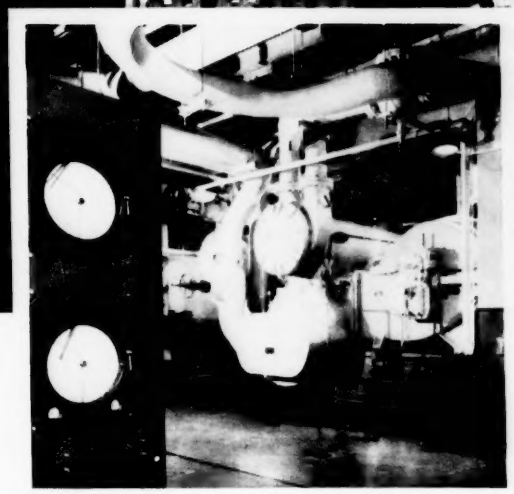


TAYLOR CONTROLLED

Carrier SYSTEM

MAKES THE SUN BEHAVE!

A BUILDING like 100 Park Avenue, which has many acres of glass wall area, is strongly affected by the heat of the sun. And since the solar factor is constantly changing with the sun's angle, the central air conditioning system must be extremely flexible, in order to keep each office in constant comfort.

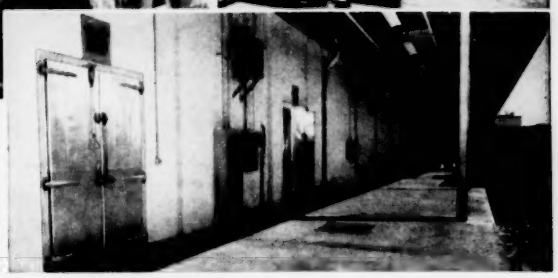
Carrier Corporation solved this problem of flexibility with the use of a Taylor FULSCOPE* Recording Controller for each of their two centrifugal refrigerating machines. Each controller operates a valve, which varies the speed of the machine according to the output temperature of the chilled water. One pen records the output water temperature, and the other records the input temperature. Thus constant water temperature is maintained in the primary air conditioning system, regardless of the effects of sun and weather on the face of the building.

Whether you need air conditioning for human comfort or for product quality, Taylor Control will help you get top efficiency out of your equipment. Write for **Catalog 5.** Taylor Instrument Companies, Rochester, N. Y., or Toronto, Ontario.

*Reg. U.S. Pat. Off.

Taylor Instruments MEAN ACCURACY FIRST

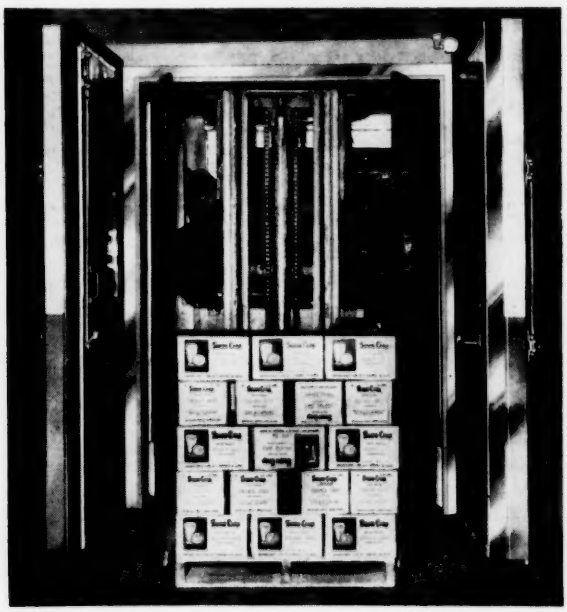
Faster handling speeds bulky loads in production line technique through wide Jamison Aluminum Clad Double Vestibule Track Doors. Note extra protection of aluminum kickplate.



Huge loading dock is spotted with Jamison Doors that lead directly into cold storage and sub-zero rooms.

New Food Fair warehouse with aluminum clad doors a Jamison FIRST

Minimum cold loss is afforded by Jamison Double Vestibule Super Freezer Door. Frostop—which prevents door from freezing shut—is on frame and astragal. Construction is aluminum cladding with aluminum kickplate.



For the 57 Jamison Cold Storage Doors installed in their new Florida warehouse, Food Fair specified aluminum cladding for protection against corrosion, mechanical damage and vapor penetration. Jamison aluminum cladding also provides bright, easy-to-clean surfaces and lighter weight doors.

Jamison Doors have been recognized as the practical and economical solution to warehousing problems everywhere. For help with *your* problem, or specific data on Jamison aluminum cladding, write to Jamison Cold Storage Door Co., Hagerstown, Md.

JAMISON

COLD STORAGE DOORS